AMERICAN MACHINIST

January 11, 1939

PLANE PRODUCTION—*Vultee meets the increased demand for more and better planes with aircraft designed especially for maximum machine work (page 1)*

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A BIGGER BUYER'S REFERENCE NUMBER THAN EVER BEFORE

★

Your copy of the Annual Buyers' Reference Number, which comes to you next issue, will be 20% bigger than any previous review. It will include 988 classified descriptions of metal-working tools, equipment and supplies, as compared with 790 in 1937 and 637 in 1936. Here is striking evidence that equipment manufacturers have made good use of the recession to provide newer and more efficient equipment to handle your 1939 production. It will pay you well to read it from cover to cover and thereafter to keep it handy as your 1939 buying handbook.

AMERICAN MACHINIST

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

FOR NATIONAL DEFENSE

Were the United States to become involved in a war tomorrow, certain disconcerting facts would immediately become plain:

Our small standing Army is ill-equipped for defense of the country, whether it be in small arms or in coast-defense guns.

Our air forces are sadly lacking in numbers of fighting planes compared with other countries.

Our Army arsenals and Navy yards have a large percentage of equipment which is obsolete, no matter what measuring stick is applied to them.

Our industries would take eight months or longer to get into the swing of producing war goods.

Unfamiliarity of our industries with manufacture of certain critical war items would impose upon them a tremendous handicap in filling early war needs as well as in supplying replacements.

Despite this bad situation, with which the public is just becoming acquainted, there is no reason to grow hysterical. Fortunately the United States does not have potential enemies at its front or back door as some countries do, and we are not in danger of attack next week or next month or next year. But it is obvious to anyone who has followed world events that the sword-rattling nations which appear ready to back up their threats by military force are in the ascendancy. Any country which disregards such developments is foolhardy. And the first instincts of a nation as well as of an individual are toward self-protection.

So it behooves Uncle Sam to put his house in order against the day when he may have to defend it on short notice. If, through no fault of his own, he should become involved in an armed conflict, it will then be too late to make a start. On behalf of the best interests of the people he must go at the job of military and industrial preparedness for an emergency methodically and coolly. The work must be stripped of non-essentials and must be carried out scientifically and efficiently, *with every suspicion removed that it might be merely another way of spending more of the taxpayers' money.*

In tackling the gigantic task ahead, the government must bear in mind that the second line of defense is as vital as the first line. The first line consists of the Army, the Navy, the Air Force. The second line is American industry, which must supply the equipment and munitions

to carry on a war to a successful conclusion. That second line must be made impregnable, it must be made to function efficiently, and, above everything else, those who man it must be trained thoroughly in their tasks.

To point out what must be done to bring both the first and second lines of defense up to sufficient strength that no enemy will dare attack us—which is the best guarantee against war—*American Machinist* begins with this issue a series of special editorial sections. It leads off with a detailed exclusive statement of our military situation and the task ahead by the Hon. Louis Johnson, Assistant Secretary of War, who is charged with responsibility for industrial mobilization.

Before this series is concluded we intend to show the need for expanding the personnel and equipment of the Army, the Navy and the Air Force; to show that the "educational orders" program must be enlarged so that the necessary dies, jigs, fixtures and procedures for manufacture of war materials will be ready for industry to use; to show that efficient fighting equipment cannot be turned out economically on obsolete tools; to show what replacement of old machinery in Army arsenals and Navy yards will do to "tune up" our industrial war set-up.

If he is to be realistic, Uncle Sam must prepare his military and industrial establishments for whatever crisis may occur.

Industrial Mobilization—Backbone of Defense

HON. LOUIS JOHNSON

Assistant Secretary of War

■ If Mobilization Day, known in army circles as M-Day, should come the first of next month, or the first of next year, how ready would the United States be to defend its territory? Reluctant though our peace-loving nation may be to consider this question, recent world events compel us to a serious consideration of it and to an appraisal of our readiness.

Our Navy, as always, would be our first line of defense. To back it up, four hundred thousand men would be called out at once for the Army. They would include most of the regular army in the United States and the whole of the national guard. Within four months we would have to be ready to put into the field an army of a million men.

But what of the equipment? That is the problem which confronts both the War and the Navy Departments, and upon which we solicit the aid of American industry. These men of America, giving themselves to the service, are entitled to their full complement of the best obtainable supplies. This, the richest of countries in natural resources and in manufacturing capacity and efficiency, with the greatest stake in peace and preparedness, must provide adequately for the needs of its first million.

Yet I say to you in all frankness that if our Army were called to battle today, it would find itself short of artillery and tanks, of combat cars and airplanes, of machine guns and of semi-automatic rifles, of anti-tank guns and ammunition, of gas masks and searchlights, of telescopes and quadrants, and of many other items too numerous to mention.

Let me tell you a few things about our artillery, which accounted for more than 70 per cent of the gunshot casualties in the World War and which is reported to be causing 80 per cent of the casualties in China. In our field artillery today practically all of the gun carriages for our French 75's belong to an old model designed more than 40 years ago. Of our improved modernized type there are but 112 in the whole army. We have no 105-mm. howitzers, a type which we find in foreign armies is taking the place of lighter calibers. We have no modern 155-mm. howitzers for counter-battery work and have developed none. Though our ordnance department has developed two improved modern heavy calibers in the 155-mm. gun and the 8-inch howitzer equal to any comparable weapons in the world, we have today but four of them in the Army. They comprise our whole modern heavy field artillery. We also need an anti-tank gun of caliber and power greater than that supplied our infantry for use by our field artillery.

We recall with chagrin the deplorable spectacle of our nation at the beginning of the World War. We declared war on April 6, 1917, and expected to end it quickly. We soon learned that we had miscalculated. Courage and willingness were not enough. If an emergency ever again arises, I do not want production of motors to stop while we try to perfect another Liberty. I do not want the manufacture of Springfields to lag so that we may have to turn to Enfields. I do not want to delay our doughboys while we wait to develop a Browning machine gun. I do not want to compel the field artillery to give up three-inch guns of our own familiar design for 75's of foreign construction. I do not want a lapse of 14 months between the declaration of war and the day that our first division is placed on the fighting line. I do not want the experiences of 1917-18 repeated.

At that time we were fortunate in our allies. In planning now we must consider what we alone could do. At the President's direction we have set out to reduce to six months the period after war is declared during which our supply preparedness must be achieved. It is necessary therefore, for us to build up a supply adequate

Camouflage hides the grim efficiency of the Army's newest "super-flying fortress", a four-engined Boeing bomber with speeds well over 200 m.p.h. Dozens of its fellows are needed for long-distance defense

for the needs of a million men. If that is done, we confidently believe that industry, if properly educated, will be able to carry the full load of a major war.

To conduct a modern war successfully, a nation must have a program not only for the raising, organizing and training of its manpower, but also for their supply and equipment. The Army arsenals and depots are wholly inadequate for the latter purpose. If we were to equip all of the army arsenals with the best modern machinery and to staff them to their full capacity, they would be unable to produce more than 10 per cent of the requirements of the Army in time of war. The function of the arsenals is rightly that of experimental laboratories rather than munitions factories.

For the other 90 per cent of our munitions needs, we must turn to civilian production. To determine the capacity and ability of American industry to produce the necessary munitions in time of war, the Army made a complete survey of all our principal factories. Owners, managers, foremen and engineers helped us at every step. As a result of these studies, we have earmarked 10,000 plants for war production. Not only in our surveys but in the improvement of our designs of technical munitions and in standardization of component parts for mass production, industry has aided the Army. Our specifications and drawings submitted to manufacturing plants have often been returned with constructive criticism and valuable suggestions appended.

No one, least of all the War Department, lacks confidence in American industry to produce what our troops may need. What does concern us is the time element that it may take industry to convert its factories from peace to war-time use. There is no better way of reducing the time factor than to educate our factories right now, in time of peace, in making items which are so necessary for full equipment of our forces on M-Day.

Our industrial needs include 7,300 items or processes of production. In selecting these items we have tried to conform as far as possible to what private industry can readily produce. We have been fortunate in finding facilities for almost all of these 7,300 items.

There are, however, approximately 55 critical items so difficult of production, so different from ordinary peace-time needs, that industry will not be able to go into production of them without some education. There are 245 plants out of our 10,000 that cannot, without further education, perform their allotted war-time tasks in the production of these vital items or processes. Part of our national security program must be educational orders for these 245 plants.

Six of these 55 items have been cared for by the $2,000,000 appropriation of Congress during the last session. That money is being spent for teaching industry to make semi-

automatic rifles, recoil mechanisms for three-inch anti-aircraft guns, and forgings and machinings for 75-mm. shells, gas masks, and searchlights.

Among the other 49 items are such vital necessities as bomb sites for airplanes, canisters for gas masks, demolition bombs and fuses for ordnance, aiming circles and range finders for the artillery, and the new 37-mm. guns and carriages for the infantry and the anti-aircraft service. The 37-mm. gun is a highly efficient instrument recently developed as a defense for our ground troops against tanks and enemy planes, and in the event of war would be essential. It is for such kinds of equipment as these that further educational orders are required. I am confident that the incoming Congress will early provide the necessary appropriations to finance them. We must learn how to produce all 55 critical items, or serious shortages may come to plague us on M-Day.

Our standard machine gun is the .30-cal. Browning, now supplemented with the heavier .50-cal. for anti-aircraft and anti-tank service. Though the basic type of this gun was developed during the World War, we now have none in reserve and some of our National Guard units are not yet equipped with it

Now let us survey the problem of our air force. Recently we believed that a program calling for 2,320 airplanes of all types by 1940 would protect us against any enemy from the air. We boasted that our air force was the pride of the skies. We held records for speed and endurance. Our pursuit ships, our attack planes, our flying fortresses and our super-flying fortresses were the envy of the world.

Today we know that these figures and records no longer hold. From Europe come reports of pursuit ships and attack planes of greater speed and better performance. Even the marked superiority of our flying fortresses is challenged.

As against Britain's $15,000,000 spent last year in its research laboratories on military aeronautics, France's $10,000,000, and Italy's and Germany's unknown expenditures, we spent only $6,000,000. In view of the tremendous importance of aircraft in the early stages of conflict, an investment now of a few extra million dollars in experimental work in this field may bring dividends in security that no amount of money can buy.

Though the rest of the world has stepped up the production of aircraft to the thousands, we still speak in terms of hundreds. England claims the building of 3,000 military planes a year. Germany boasts of an annual capacity of more than 12,000 fighting craft. In the calendar year 1938 it is estimated that we produced in the United States only about 3,000 for all purposes—military, commercial and private.

Contracts must be given to the aviation industry to build us enough planes to meet our full military needs on M-Day, and this must be done at no sacrifice to the growing and pressing needs of our commercial aviation which today leads the world. We must achieve mass production of airplanes in this country quickly.

It will not be amiss to address a few words directly to the metal-working industry on the relationship of the War Department to manufacturers who are cooperating so splendidly in our program for expanded armaments and for industrial mobilization.

We in the War Department are striving to complete as rapidly as possible the specifications and drawings needed for the information of industry. When proposals were issued for educational orders, I was gratified to find that the drawings and specifications were available at once for the items so far approved. However, there still are more than 25 per cent of our items, many of them vital to our cause, for which specifications and drawings have not yet been finished. We expect to complete the job as speedily as possible.

Members of the general staff of the War Department, line officers and supply officers have been instructed to work together toward standardization of equipment. Without standardization, mass production will be impossible. In the interests of standardization we are striving toward simplification of military machines and weapons. I realize that some degree of complexity is inescapable but we must try to hold it to a minimum. When faced with the alternative between a complicated, delicately constructed machine of superior performance and one less perfect but more easily adjusted to mass production, we must choose the latter. I am inclined to the general view that what private industry can make should be the deciding factor of what the Army can use and what private industry makes best is exactly what the army must use. The standard may not be the most efficient that can be visualized, but if M-Day should come tomorrow, we will have to go into production on that basis.

In its dealings with private industry the War Department wishes to simplify its procedure as much as possible, bearing in mind the restrictions imposed by acts of Congress. The department does not wish to impose rules and regulations which hamper rather than expedite the carrying out of the far-reaching plans for national defense. Perhaps it

would be well to set down here the rules to which the department holds in making awards to private industry for supplies. The first rule is economy of purchase. The second, specified by Congress except in the case of educational orders, is that there shall be competition for the contract. The third, is assurance of quality. The fourth, the department insists upon exact performance of contracts made with it. The fifth is avoidance of personal interest. Contracts are allotted without personal or political preference. The sixth rule is that the department shall show complete impartiality and fairness to dealers. The seventh rule is the fostering of domestic industry. Eighth, and I might add, an important consideration, is prompt payment for materials and equipment delivered.

Finally, the department insists upon careful compliance with the law by all suppliers.

In this recital of our problems connected with national defense I have deliberately avoided use of the term "rearmament" which is so commonly heard. "Rearmament" presumes that once there had been an armament. It is not an exaggeration to say that America has never had an adequate army and navy. Today it finds itself in a world where force has begun to play a dominant role in the affairs of men and is compelled in self-defense to build up its armed forces. Revolution and counter-revolution, intolerance, imperialistic designs and selfish ambitions today run rampant. Rudely awakened from a false sense of security, the time has come to gird our loins. Today more than ever we must realize that adequate national defense is the most certain guarantee of our freedom, of our institutions and of our way of life.

Industrial mobilization finally is taking its rightful place among the more important factors in our national defense. Armed forces cannot long operate unless they are properly sustained from their own supply bases. They must be supported by their own farms and by their own factories and by their own industries. Supply has taken on a new dignity in war plans. With the help of the metal-working industry, as well as of other industries, the country will be prepared for M-Day should it ever come. In that preparation among the vital needs are the building up of a six-months' supply of materials except food and clothing, adequate modern equipment for Army arsenals, and the education of industry in the manufacture of all the 55 critical items with which industry normally is not familiar. I have every reason to believe that Congress will see that funds are appropriated to speed these preparations to a successful conclusion.

The ARMY Today and Tomorrow

■ After the World War, the American people were fed up with "saving the world for democracy". They withdrew from international complications, and sentiment was strong for staying on this side of the Atlantic. The Navy would be sufficient protection against an aggressor, and the Army could be reduced to skeleton size.

But the airplane, a short-range combat and observation weapon during the World War, was improved until it was possible to fly it long distances, carrying heavy loads of bombs. Airplane carriers were developed to provide a floating base of operations. The steam turbine, the diesel engine and oil firing were improved to increase the speed and cruising range of warships; the vicious little torpedo-carrying speedboat supplemented the submarine; and finally, America awoke to find itself between two badly shrunken oceans.

Many of the responsibilities of defense fall upon the Army. Only by assured defense of the home bases and outlying possessions can the Navy be given complete freedom of action. In the unlikely event of a naval defeat, the Army would be called upon to withstand the major function of defending the mainland of the United States against direct attack by raiding forces.

We are trying to fulfill these responsibilities with one of the smallest standing armies of any major power—165,000 men and 12,632 of-

One of the 14-in. railway rifles speaks in defense of the Panama Canal. Similar guns, supplemented by fixed-mount 16-in. guns, firing a 1-ton shell 30 miles, are needed for coast defense, but we do not yet have enough for our outlying bases, Hawaii and the Canal

The Garand .30-cal. semi-automatic rifle is a natural for a nation of sharpshooters. It can fire 30 or more aimed shots a minute for long periods of time, for former fatiguing recoil now is used to reload the gun. Though it is a far better gun than the Springfield, world's finest standard army rifle, the United States Army has only 8,000 Garands and is getting only 5,000 more each year

ficers (only 100,000 of whom would be available in the continental United States) supplemented by 200,000 National Guardsmen and 100,000 officer reserves. The job can be done, if this force is equipped with the latest and most effective fighting implements. But today much of the proper equipment is lacking.

In the World War, over 70 per cent of the fire casualties were caused not by infantry, but by artillery. As a consequence every nation ha. been striving to develop even more effective artillery. Ranges have been increased, flexibility improved, weapons redesigned for high-speed transport, and new types developed. The United States has not been behind in this development; it has designed as many new artillery weapons as any major power. Pilot models of these new designs have been manufactured and tests of these pilots have proved the designs are at least the equal of those of any other major power. Quantity production has not been possible due to lack of sufficient appropriations. For some types there is no ammunition; some of the others have not even been seen by the National Guard which constitutes over half of our first-line-defense!

The weapon used in largest numbers is the 75-mm. gun. We have over 3,000 of these, all of the 1897 model, although about two-thirds of them have been adapted with stub axles, anti-friction bearings and pneumatic tires for high speed towing. But most of them still have the original carriage with limited traverse and elevation. We have several new types, including anti-aircraft models and a split-trail field gun with the gun and recoil mechanism mounted on a kingpin carriage permitting higher elevations and wider traverses; but of these models just 140 have been built.

The 105-mm. howitzer, firing a 33-lb. shell is more effective against troops under cover or behind hills, because it fires on a curved trajectory instead of a flat one. European armies are adding them as fast as they can. Pilot models of this weapon are on hand, and quantity production can be accomplished when funds are available. We are still using World War models modified for faster towing, but with the weaknesses of the old 75-mm. as far as flexibility is concerned. The new 155-mm. gun has a maximum range of 26,000 yd. Considering its size and its mobility it is one of our most useful gun types.

Most powerful of field-artillery weapons is the 240-mm. howitzer. It fires a shell 10 in. in. diameter, a distance of 17,000 yd. Its 48,000 lb. weight forms four tractor loads. Due to its cumbersome nature and its uses of so much transport, a new weapon of the same fire-power, but with greater range and flexibility, is needed. Heavier weapons are principally railway guns, similar to those for coast defense. Our 8-in. railway gun for example fires a 200-lb. shell about twelve miles.

We have one complete weapon of new design, shooting 50 per cent farther at twice the speed, and two more building. Only these three are the equivalent of the secondary batteries on a modern battleship. Most of our major Atlantic Coast protection consists of 12-in. disappearing guns of an obsolescent type, and 12-

in. mortars, and 14-in. and 16-in. guns. Modern warships have been able to outshoot these 12-in. cannons for 30 years. We need more modern 14- and 16-in. guns of the type protecting Hawaii and Panama Canal which fire a 1-ton shell 30 miles.

The Coast Artillery is also entrusted with anti-aircraft protection for major cities. To do this job we have a few 105-mm. guns, a quantity of 3-in. guns, and a brand-new pilot model 37-mm. automatic cannon. Except for these, all we have is machine guns, and only about half as many of these as we need. Machine guns firing non-explosive shells are useless against high-flying bombers. Only the larger guns are effective.

In a "meeting engagement", the cavalry is presumed to be the first unit in contact with the enemy. We have been active in developing highly mobile mechanized equipment. We now have one highly publicized mechanized cavalry brigade and need another. Most of the combat elements are highly special, but armed with this equipment, such a unit can deliver several times the volume of fire of a conventional cavalry brigade.

The infantry, the ground-occupying and holding branch of the Army, in support of which all other units operate, is similarly ill-equipped. In the World War many American infantrymen were forced to go into the trenches with the Enfield rifle. We now have enough Springfields, but about one in four is worn out. For years the world's finest standard rifle, the Springfield is now far outclassed by the new Garand, invented in 1930 by a Springfield arsenal employee. It can deliver 30 aimed shots a minute with superior accuracy because it is practically without recoil kick. We have only 8,000 of these weapons, and at present are producing about 5,000 a year.

The great basic weapon for defense against cavalry is the 0.30-cal. Browning machine gun. Because we have too few of them the infantry is forced to use the automatic rifle.

A newer, heavier machine gun, the 0.50-cal. was planned for defense against tanks and attack planes. Thicker armor on the new tanks makes this gun of little value except at close range, but it works well against armored cars. The anti-aircraft type of which the Army has about half enough, can fire 600 shots a minute.

The only standard infantry weapons firing explosive shells are the 37-mm. gun, the 81-mm. mortar, and the 75-mm. field howitzer. The army has just announced a new 37-mm. anti-tank gun. It has ordered 228, about half enough to equip the Regulars, but none for the National Guard.

These particular weapons are described because they are army made except for certain purchased parts, and private industry has had no experience in building them. In time of war they and the ammunition for them must be made by the Metal Working Industry. The arsenals have capacity to produce less than ten per cent of the Army's wartime needs. This means that the 10,000 "key" plants now in the war department's files would immediately have to begin manufacturing the products already assigned to them, but for which, in many cases, they are not now equipped. The five-year "educational" order plan is designed to remedy these deficiencies on critical items. Some 275 plants in the metal-working industry are selling over $50,000,000 worth of munitions, material and aircraft to the Army each year. This year's ordnance purchases are detailed in Table I.

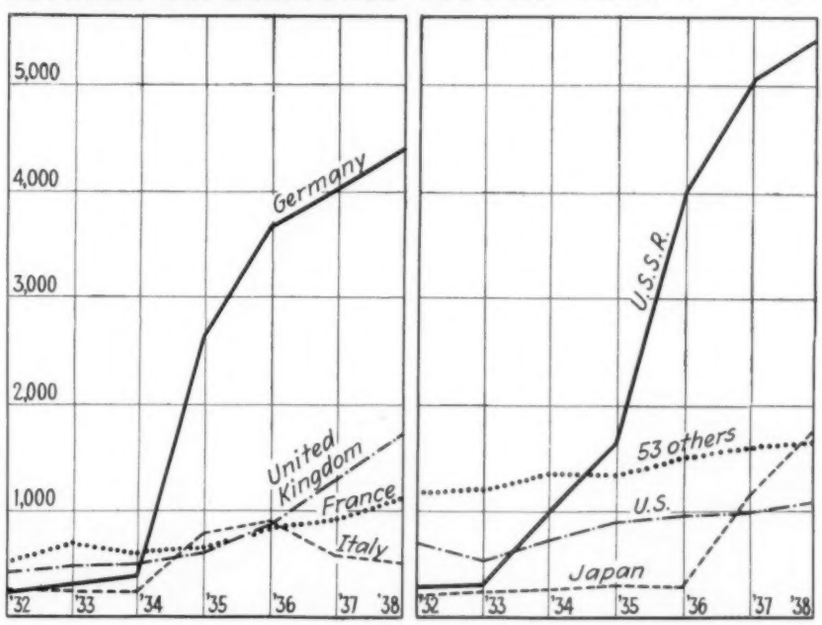
In addition to the unusual items not similar to common commercial products there are dozens of other items comparable to commercial equipment such as trucks. Of these the army has only 23,000 of the 37,000 it needs. Our Army air force rates approximately fifth, being a third the size of Germany's, for example. Civilian aircraft could be adapted for many of the uses if necessary gun mounts, bomb slides, and similar conversion parts are available.

Civilian radio, telegraph, telephone and camera equipment could probably be adapted readily to Army uses, as well as Engineer Corps equipment. But there is real potential danger in our shortage of arms and ammunition for which we have no peacetime equivalents and only a few arsenal-trained workers skilled in their manufacture.

1939 ORDNANCE PROCUREMENT FROM INDUSTRY

3-INCH ANTI-AIRCRAFT MATERIAL PARTS (Includes electric brakes, spring assemblies, etc.)	$7,634,254
SPECIAL MACHINERY (Includes turret lathes, grinders, ammunition and fuse-making machinery, etc.)	3,207,156
INSPECTION GAGES (Includes all types, to more than 300 tool and gage companies throughout the U. S.)	240,150
AMMUNITION ITEMS (Includes bombs, shell forgings, etc.)	4,760,267
ARTILLERY ITEMS (Includes armor plate, tank engines and transmissions, gun mounts and parts)	809,397
SMALL ARMS ITEMS (Includes machine guns, pistols, shells, etc.)	3,124,680
TOTAL ALREADY AWARDED	$19,775,904
TOTAL TO BE AWARDED IN 1939 (fiscal year)	24,631,444

DEFENSE EXPENDITURES 1932-38 *MILLIONS OF DOLLARS*



The NAVY Today and Tomorrow

■ When the war-weary United States retreated into "splendid isolation" at the end of the World War, the Navy as well as the Army was deflated. Under the terms of the Treaty of Washington in 1922, we scrapped 30 large ships totaling over 750,000 tons. We did not build up to our allowed treaty strength of replacing overaged vessels. Assistant Secretary of the Navy Charles Edison is authority for the statement that at the close of the war we had the mightiest navy in the world, and soon after the treaty took effect and our scrapping program was carried out we were a poor third.

Little or nothing was done in the way of new Navy building during most of the twenties. It wasn't until 1933 that Congress authorized construction of 32 ships, or more than the number authorized in the previous decade. During the period of inactivity ship design and building became almost a forgotten art. The result was that when the new Navy program started, construction was delayed because of the "bugs" which had to be straightened out.

In 1934 Congress followed the advice of the President that the Navy be built up to full treaty strength. It passed the Vinson-Trammell Act providing for 141 new ships of various types. When world conditions failed to improve and the treaty expired, the President asked Congress to exceed the treaty limits by 20 per cent. Under legislation passed in 1938, 46 additional combatant ships and 22 auxiliaries were authorized and a start was made on the program for the so-called "billion-dollar" Navy.

Under the terms of the London Treaty of 1936, three battleships could have been started in 1937. Actually, two were begun, the *North Carolina* and the *Washington*. Four can be started in 1939 and one each in 1940, 1941, 1942 and 1943. At present contracts have been awarded for all four ships authorized for 1939, three to be built in private yards and one in Navy yards.

Under the act of last May 17 funds were made available for an aircraft carrier, two light cruisers, a destroyer tender, one large and two small seaplane tenders, two oil tankers, a minelayer, a minesweeper, two fleet tugs, and several smaller vessels. The act also increased by 20 per cent the authorized composition of the Navy in under-age vesels and authorized a naval aircraft strength of not less than 3,000 useful planes.

The 1939 Naval Appropriation Act provided $138,000,000 toward cost of two battleships, two cruisers, eight destroyers, six submarines, a minesweeper, a submarine tender, a fleet tug and an oiler, all now under construction. The Deficiency Act of June 25, 1938, provided for two battleships, one aircraft carrier, two cruisers, one mine layer, one large and two small seaplane tenders, a destroyer tender, two oil tankers, a minesweeper and two tugs.

As indicated in Table I, the United States now has in process of construction six battleships, four aircraft carriers, 15 cruisers, one mine layer, 55 destroyers and 20 submarines. From July 1, 1937, to June 1, 1938, seven destroyers and three submarines, were completed and two aircraft carriers, five cruisers, 13 destroyers and two submarines were commissioned. All major units are shown in Table I.

Necessary as an auxiliary service in time of war, the merchant marine is being rehabilitated under the program of the Maritime Commission. The Navy needs 20 tankers fast enough to accompany the Fleet, as well as 300 smaller ones of various speeds and sizes for other work. The Navy is building five of the tankers.

Last Spring the Maritime Commission proposed that it subsidize the construction of privately-owned tankers by paying for the extra propelling machinery required to suit Navy

TABLE I—NAVIES OF PRINCIPAL MARITIME POWERS

	United States			British Empire			Japan			France			Italy			Germany			Russia		
	TOTAL BUILT	UNDER AGE 12/31/37	BUILDING OR APP	BUILT	UNDER AGE 12/31/37	BUILDING OR APP	BUILT	UNDER AGE	BUILDING	BUILT	UNDER AGE	BUILDING	BUILT	UNDER AGE	BUILDING	BUILT	UNDER AGE	BUILDING	BUILT	UNDER AGE	BUILDING
Battleships	15	15	6	15	15	7	10	10	–	6	6	5	5	4	4	6	4	4	3	3	–
Monitors	–	–	–	3	3	–	1	–	–	–	–	–	5	5	–	–	–	–	–	–	–
Aircraft Carriers (Hvy)	3	3	4	6	6	7	5	5	1	1	1	2	–	–	–	–	–	2	–	–	–
" " (Lt.)	–	–	–	2	1	–	2	2	3	1	1	–	–	–	–	–	–	–	–	–	–
Cruisers (Hvy.)	17	17	1	15	15	–	18	12	–	7	7	–	7	7	–	–	–	3	1	1	7
" (Lt.)	10	10	14	45	26	24	23	15	2	12	12	3	15	12	–	6	6	4	6	o 3	–
Destroyers	204	37	55	160	89	40	105	79	6	70	69	20	114	81	36	29	24	11	35	21	8
Submarines	86	24	20	53	40	20	57	41	3	76	76	22	90	83	39	39	36	27	122	114	19
Torpedo Boats	–	–	–	–	–	–	12	12	–	–	–	–	3	–	–	–	–	18	–	–	–
Gunboats	–	–	–	–	–	–	1	–	–	–	–	–	6	6	–	10	10	–	–	–	–
Sub. Chasers	–	–	–	–	–	–	2	2	3	–	–	–	1	1	–	–	–	–	–	–	–
TOTAL	335	106	100	299	195	98	236	178	18	173	172	52	246	199	79	87	80	69	167	142	34
Tonnage Built	1,100,890			1,295,303			918,499			514,416			448,024			168,226			217004		
" Under Age	868,350			1,112,373			780,978			513,501			399,445			138,759			180,543		
" Building	447195+			589,915			68,260			279,573			238,444			276,898			52,358		
Total Last Two, Tons	1,315,545			1,702,288			849,238			793,074			637,889			415,657			232,901		

Planes aboard the U.S.S. Ranger *look out over the sea and the companion aircraft carriers* Saratoga *and* Lexington *during Fleet maneuvers in the Pacific. These three are to be supplemented by four more aircraft carriers now building or appropriated for*

speeds and not feasible in ordinary commercial operation. Standard Oil of New Jersey was the first company to take advantage of this arrangement. It is now building twelve tankers at a cost of $27,000,000, the Maritime Commission providing an additional $10,500,000 to triple the installed horsepower and make the vessels true Navy auxiliaries. Other similar plans are in the making.

Shipbuilding facilities in the United States are relatively limited because of the long hiatus in ship construction work after 1918 while the old war-time ships were being used up. The apathy shown toward shipbuilding by the Central States hasn't helped matters. Only four private and six Navy yards can accommodate major craft. Ways are few in number, so that careful scheduling must be done to prevent conflict between the Navy program and necessary merchant shipbuilding.

Few people are aware that the

TABLE I—THE EFFECT OF $1,000,000 OF CONSTRUCTION-CONTRACTS AWARDED FOR NAVAL VESSEL CONSTRUCTION

Expenditures for:		
Labor	$391,000	39.1%
Material	406,000	40.6%
Other expenses and profit	203,000	20.3%
Man-hours worked:		
At the construction site		491,000
In mines, factories, transportation, and in administration		589,000
Value of material orders placed:		
ALL MATERIALS		$406,000

Aluminum sheets, shapes and castings	$2,000	Lumber	2,000
Boilers	10,000	Machine tools	2,000
Bolts, nuts, washers, rivets	3,000	Metal doors, shutters, molding and trim	4,000
Electrical machinery, apparatus and supplies	52,000	Non-ferrous metal castings, sheets, pipe and tubing, etc., not elsewhere classified	26,000
Electric wiring, fixtures	24,000	Paints and varnishes	3,000
Elevators and equipment	4,000	Petroleum products	5,000
Engines, turbines, auxiliary machinery and equipment	47,000	Plumbing fixtures, supplies	1,000
Forgings, iron and steel	10,000	Pumps, pumping equipment	12,000
Foundry and machine-shop products, not elsewhere classified	56,000	Steel-works and rolling mill products, not elsewhere classified	90,000
Furniture and furnishings	4,000	Wall plaster, wall board and insulation material	2,000
Hardware, miscellaneous	1,000	Wire, wireworks products	5,000
Heating, ventilating equipment	6,000	Other materials	33,000
Instruments	2,000		

(1) Estimate based on a study made of the construction costs of the following naval vessels constructed in private shipyards: Ten destroyers, two submarines, two aircraft carriers, two light cruisers, and one heavy cruiser.

TABLE II—ESTIMATED COSTS OF U. S. SHIPS

Approximate Total Costs Covering Construction, Hull, Machinery, Armor, Armament and Ammunition

Vessel	Approximate Estimate	Labor at Site	Labor Away From Site	Cost of Raw Materials
Battleship	$70,850,300	$35,000,000	$25,223,300	$10,627,000
Cruiser	22,300,000	11,000,000	7,950,000	3,350,000
Aircraft carrier	31,600,000	15,800,000	11,130,000	4,670,000
Destroyer	8,000,000	4,000,000	3,200,000	1,300,000
Submarine	6,500,000	3,000,000	2,500,000	1,000,000
Submarine tender	12,600,000	6,500,000	5,200,000	1,900,000
Seaplane tender	13,000,000	6,500,000	4,550,000	1,950,000
Destroyer tender	13,000,000	6,500,000	4,550,000	1,950,000
Oiler	6,000,000	3,000,000	2,100,000	900,000
Minesweeper	2,500,000	1,250,000	875,000	375,000
Fleet tug	2,000,000	1,000,000	700,000	300,000

building of Navy ships benefits all parts of the country industrially. Navy studies show that every State in the Union contributes elements to a ship, and that man-hours worked away from the site are about 20 per cent greater than those on the site itself. As shown in Table II, about 40 per cent of each dollar spent goes for raw and partly-finished materials, or for completed parts such as boilers, bolts, nuts, etc. Of the 40 per cent so spent, the metal-working industry gets about 36 per cent.

About one-third of the cost of a tanker or cargo ship, and about 40 per cent of the cost of a passenger ship, is represented by machinery. The Navy proportions detailed in Table II are followed closely in the building of merchant ships. Further significant facts, including the approximate cost of each type of naval vessel, are set forth in Table III.

Naval aircraft production has far outstripped the building of tenders and adequate shore bases. Even so, Navy aircraft numbers only 1,390 units, with 642 planes on order.

Few people will quarrel with the statement that the Navy is our first line of defense. Action has been taken lately to raise its strength and efficiency, and rightly so.

Industry's M-Day Is Now

■ Present needs of the Army and Navy have been outlined. The Army must be adequately equipped; the Navy is well along on its plans for rounding out the Fleet as the country's first line of defense. A program is being formulated for an increased air force. All of these seem essential.

But more important than the military establishment is the set-up behind the lines to turn out ships, guns, ammunition, food and other war materials. The world knows that the United States has the finest industrial system anywhere, that we have a genius for producing goods of all kinds *en masse*.

Given the opportunity to attune itself to war activities, to transform its factories from production of bathroom fixtures to manufacture of artillery shells, American industry can furnish the military organization with everything needed to win a war. But it would take months on end for industry to make that switch-over. And the world knows it. We are not geared for war production, as other countries appear to be.

Unfortunately when the world thinks of the United States at war, it pictures the United States of 1917, a nation floundering for months before it found itself. If war were to come tomorrow, we would be in the same unorganized mess as then. It would take precious months before industry began to function with any degree of efficiency.

Unfamiliarity of industry with war duties and lack of modern manufacturing equipment in Army arsenals and Navy yards would prove a tremendous handicap. A start is being made toward removing this handicap, but the action must be speeded. And that action transcends in importance the building of a gigantic military establishment—and will cost far less.

Machine tools of the kind required by arsenals and Navy yards cannot be built in a day or a week or, in many cases, in a month. They must be provided in adequate numbers, and of modern design, before vital war material and ships can be fabricated. To wait until a war starts to

All units need anti-aircraft defense mounts—few have them

begin making them is even worse than not arming our military forces properly.

What is the condition today of arsenal and Navy yard equipment? Considerable money is being spent to replace old machinery at arsenals with new, yet some of the arsenals are far behind private industry in modernization. And it must be remembered that almost all our arms and ammunition are produced in these arsenals. To cite the backwardness of the government in providing modern equipment for these arsenals, more than half the machinery in one arsenal was bought in World War days (over 20 years ago) and a considerable percentage of the remainder dates back over the years to a gunstock profiler bought prior to 1850. That is a condition which no alert private manufacturer would tolerate in his own factory.

Navy yard equipment is being rehabilitated faster than machinery at arsenals, but won't be in good condition for years to come so far as age of equipment is concerned. Annual expenditures at all yards for some years prior to 1930 were paltry. Though in the nine fiscal years from 1930 to 1938 inclusive $11,200,000 was spent, most of the machine tools are still obsolete if judged by standards of private mass-production industry. The average age, in fact, is more than 19 years today. A program has been launched to reduce the average age of machine tools to 15 years by the end of the 1941 fiscal year.

That program calls for an outlay of $16,000,000. About two-thirds of that sum will be spent to replace existing equipment and the remainder for additional machinery made necessary by changes and developments in manufacture or design. The elimination of "choke points" caused by machine shortages in the yards has been made difficult, however, by the greatly expanded shipbuilding operations in the Navy. It likewise is difficult to get the yards back onto a uniform one-shift basis (it has been necessary to work two shifts on many machines to keep up with demands).

The "big Navy" program, in other words, bids well to be equal to any emergency that might otherwise have been expected. By the time the present shipbuilding program reaches its peak a few years hence, the number of employees at Navy yards will exceed those during the World War. The further speeding up of Navy yard modernization, therefore, is urgent.

Army arsenals should really be considered as laboratories developing new products. It is industry's job in time of war to prepare for rapid and economical manufacture of these new products and to turn them out in large quantities. It is a task of converting a laboratory-created product into a mass-production item, and it requires both industrial training and design modification to achieve practical results.

Not the least of the arsenal problems is the devising and producing of hundreds of gages, jigs and fixtures needed in manufacturing these products. One of the 865 parts of the 155-mm. howitzer takes 70 gages in manufacture! So the job of providing the tooling up for wartime operations should be done now rather than after war starts, for it then will be too late.

All of these considerations make clear the fact that industry must be familarized with war-time duties so that the period of preparation after war begins is at an irreducible minimum. The way to do that is clear: award so-called "educational orders" for critical war items in sufficient volume that industry will be tooled up for any crisis which may occur. The $2,000,000-a-year expenditure for this purpose for the next five years is not enough, according to the testimony of Assistant Secretary of War Louis Johnson. That amount must be increased many times to do the job right.

There must also be widespread distribution among private industry of ordnance orders for the Army and Navy. This is a sensible way of educating industry on non-critical items. The result of such action would be a thorough understanding by industry of the manufacturing problems involved and a building up by our armed forces of necessary reserve supplies as well as of present-day requirements.

Another vital element must not be forgotten—training of skilled men to keep our military machine functioning smoothly. A high government authority believes that the training of a large force of skilled aircraft mechanics is even more important than the training of pilots. This training must be extended through all branches of the service and through industry itself.

This light tank, with its heavier counterpart, is essential in attacks on fortified defense positions

We agree with Walter Lippman who wrote recently in the *New York Herald Tribune,* "The real problem of national defense today . . . is to prepare so that if war comes we shall, without unnecessary loss of time and therefore without useless loss of lives and of money, be able to mobilize our whole national strength. If we can do that promptly and efficiently no nation and no probable combination of nations could prevail against the matchless resources of this nation; if it is clear in advance that we are ready and willing to mobilize our whole national strength it is unlikely that any nation will challenge us. But if we are not ready to mobilize our reserves, if it is evident that it would take two or three years of muddle before we could make our potential strength effective, then no navy we can now build, however good, will give us real security.

"We must realize that if the emergency comes, we shall not be able to order ships, planes and guns as we might order a new automobile. We shall find, as we found in 1917, that before we can produce sufficient armaments we have to produce the plants capable of producing the armaments. Before we can equip the plants we shall have to make the tools. And if we are to sail the ships, and shoot the guns, and fly planes, we shall have to train sailors and gunners and aviators, and men to command them, and men to train them. These are the things that cannot be improvised. These are the things that take not weeks but years to create. Plants, machines, tools, skilled workers, technicians, industrial managers, pilots, mechanics to service and repair planes, shipyards, naval bases, officers—these are not to be improvised. Yet in modern warfare, they are all important."

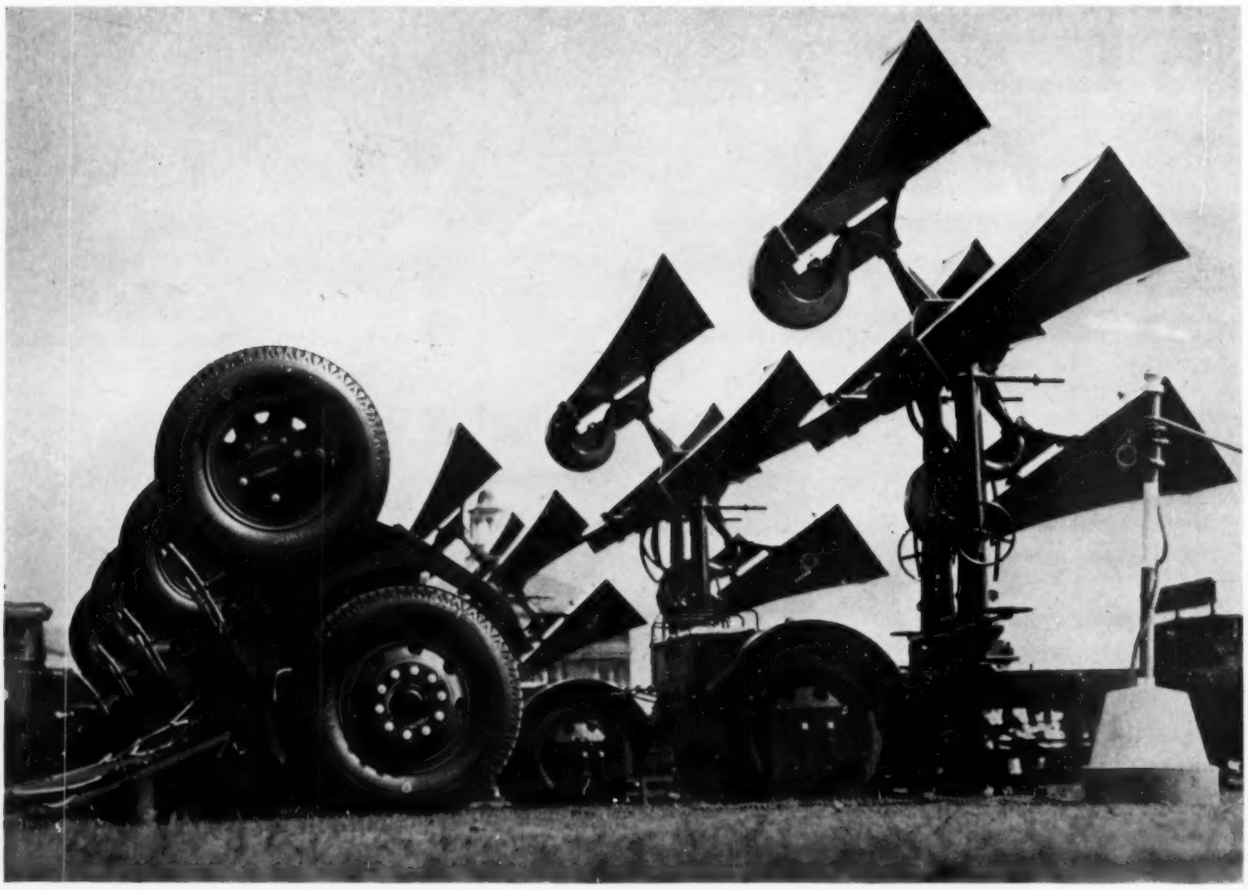
We must not make the unforgivable error of assuming that a war involving the United States is inevitable. There is abundant evidence that the American people shun war more today than ever in their history. They have been silent spectators too recently of war as brought to them by newspapers, magazines and the radio to show any enthusiasm for it. And we applaud the magnificent efforts of Secretary of State Cordell Hull as a shining example of America's striving for peace.

It is a tragic fact, however, that recognized principles of international law no longer are adhered to by some countries, that solemn treaties between nations have been openly flouted or declared inoperative because of trumped-up excuses, and that a feeling of national insecurity as well as of economic insecurity has swept the world.

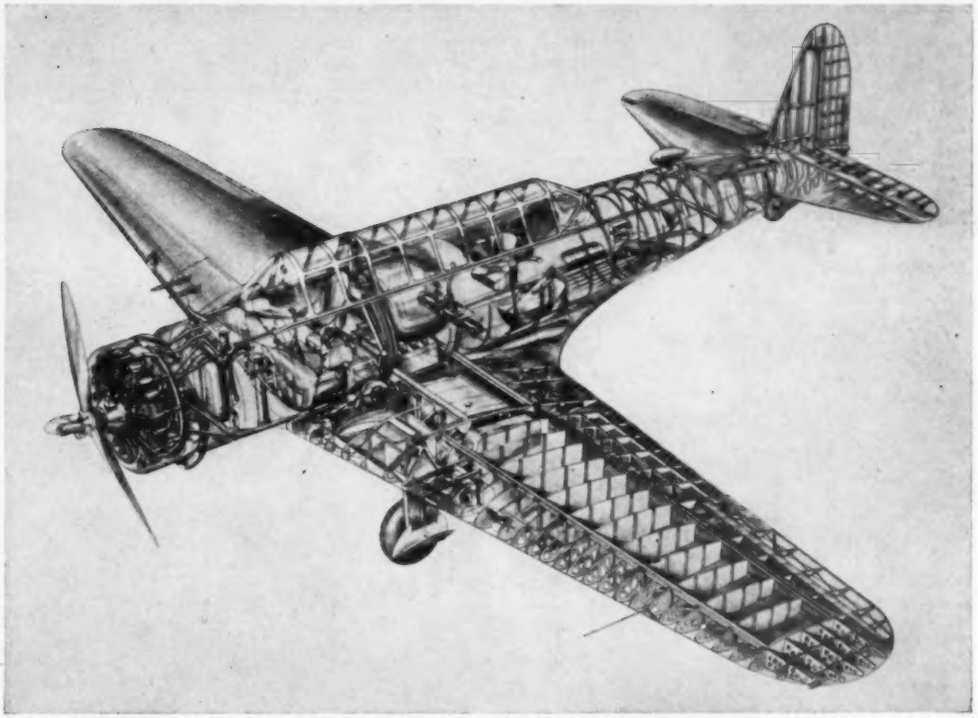
The world situation seems to demand that while we work for peace we must be ready for armed conflict. Until a brighter era dawns, we cannot do other than advocate the program outlined in these pages.

For more than ten years *American Machinist* has sponsored editorially the modernization of army arsenals and navy yards and has championed the placing of educational orders with industry to familiarize it with manufacture of critical war items. The need for industrial preparedness has been driven home in over 100 editorial pages describing inadequate conditions and proposing remedies.

Back in 1914–1918, when ships carried only war necessities, *American Machinist,* with vital information on munitions manufacture, was the only magazine permitted cargo space.



Sound locators are the ears of anti-aircraft defense. Newer types aim the guns and fire them electrically, leaving little to the human factor



The wide range of size and shape of parts that go into the assembly of a modern plane are indicated in this drawing of the Vultee V-11GB attack-bomber, which shows structural details and the installation of various parts and assemblies

Machine-Made Planes

Extruded sections, forgings and castings—all of which must be finished by machining—are finding new applications in modern all-metal plane structures

DON I. CARROLL
Plant Manager, Vultee Aircraft
Division of Aviation Manufacturing Corporation

WE THINK we have produced, in the Vultee V-11GB attack-bomber, the most nearly machine-made airplane now in production anywhere. At the present time about twelve per cent of our total labor hours is spent in the machine shop; and that is just a healthy start.

The place of the machine shop in modern airplane production frequently is not fully appreciated, even by some of our more advanced aircraft designers. Technological changes in methods of design and manufacture of airplanes have been so rapid that engineers have not yet had time to explore adequately any one construction method. However, with the increasing acceptance of all-metal structures for aircraft the machine shop has assumed increasing importance from the design standpoint.

In addition to the work of the machine shop proper, a great deal of the job of manufacturing the Type V-11GB plane is done by drop hammers, hydraulic presses, punch presses, high speed riveting machines, portable pneumatic and hydraulic riveters, electric welding machines, using the seam or shot-weld processes, power brakes and shears, special profiling machines adapted from wood-working equipment, and assembly jigs used for drilling and cutting operations to insure uniformity of work.

Many modern airplanes are still built largely of wood, or wood and fabric. Even in the case of all-metal airplanes we have different schools of design practice, including substantial use of welded steel tubing, wide use of flat riveted sheet metal structures of light alloys, or spot welded sheet structure using stainless steel alloys. So it is not surprising that many people in the aviation industry have not yet appreciated the potentialities of the machine shop for speeding production, reducing costs and simplifying maintenance. Fortunately, the bulk of the aviation industry is giving increased attention to machine methods; to the design of airplanes for machine production; and to the design of ma-

Progressive steps in the assembly of an all-metal airplane fuselage is indicated in this view of the fuselage assembly bay; rotating fuselage jigs were designed especially to facilitate this particular operation

chines for aircraft production work.

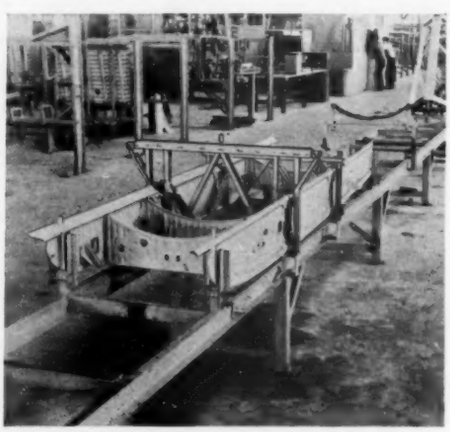
This is vital, not only to the aviation industry, but to the national defense. For so long as aircraft are built by hand methods we cannot hope for quantity production, so essential in times of national emergency. Airplanes that are built largely of welded steel parts cannot, broadly speaking, be built in mass production such as may be required in time of war. This is true because a welded plane structure must, due to its very nature, be fabricated slowly and with extreme care. But a structure which is built up from a number of machined parts can be assembled quickly by many men working simultaneously; and the component parts can be produced in desired quantities in any good machine shop.

Furthermore, a machine made structure, if properly designed, can be maintained cheaply and repaired quickly. There are few places today where fundamental tools such as the lathe and drill press are not available. A machine made airplane comes apart easily for inspection or repair. Damaged parts are easily reproduced and installed. Parts depending upon gas or electric welding, or molded woodwork, must be taken to experts in such work; and such experts are not always available.

At this point the reader may properly ask, "What is a machine made airplane?" or "How can an airplane be designed for machine production?" Both questions can be answered satisfactorily by giving a description of the V-11GB attack-bomber. This airplane was developed from the original V-1A commercial transport plane which was designed and built in some numbers at a time when aluminum sheet structures were first becoming popular. There were many hand forming operations used and, from a production viewpoint, the inherent advantages of the all-metal construction were lost.

Nevertheless, the Vultee V-1A represented a step forward from contemporary production design practise. This was largely due to its use of drop hammer forming for some parts of the wide use of flat sheets requiring no forming whatever, as on the fuselage.

When our engineering department undertook the development of the V-11GB they literally "threw the books away" so far as current practices were concerned. An intensive program of production engineering was initiated to determine what types of materials and processing operations could be applied to the new plane to achieve greater production economy, improved maintenance

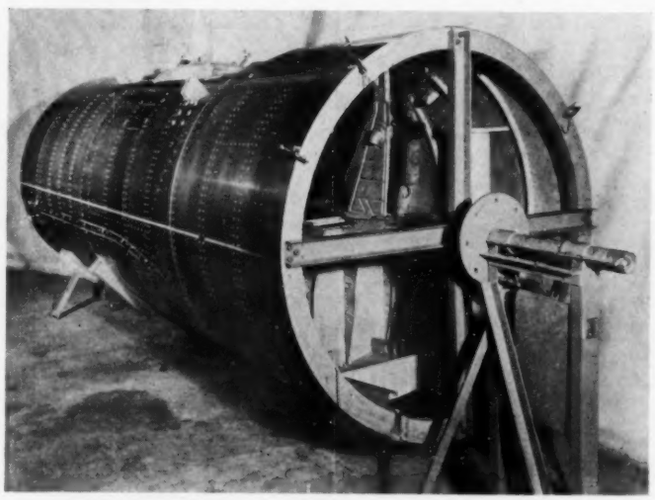


The keel structure, or backbone reinforces the under portion of the fuselage. This unit permits fuselage cutouts for observation and bombing windows; it also serves as a skid for belly landing with wheels retracted

standards, and better interchangeability of parts without sacrifice of structural or aerodynamic qualities of the original V-1 type. Their studies led them into two broad new fields.

The first was typified by development of new machines and methods for the fabrication of sheet metal parts. The second was the application to the design of a much greater proportion of machine shop processed parts, such as extruded sections, forgings and castings, of light aluminum alloys. The result has been shown through quality productions, by aircraft production standards, of the Vultee V-11GB in a relatively small factory with a minimum labor cost per plane. And today several million dollars worth of Vultee attack bombers are serving in the air corps of five different countries and daily demonstrating the ruggedness in operation, and the efficiency in maintenance, of machine built craft.

The Vultee V-11GB is a high performance single engine low wing monoplane of all metal construction. With a wing span of 50 ft. and length of 37½ ft., the ship has a gross weight, as a bomber, of 11,757 pounds, a cruising range of 2,190 miles, and a top speed of 230 miles per hour when carrying an 1,100 lb. bomb. As an attack plane the speed is increased to top of 251 miles per hour, with a range of 1,040 miles. Normal crew is three men, including pilot, gunner-observer, and rear bombardier-gunner.



Circular fuselage sections for the Vultee attack-bomber are built up on rotating jigs developed especially for this operation. A separate jig is used for each individual section: these sections later are joined together on master jigs

Generally speaking, the fuselage is built up from flat aluminum alloy sheets wrapped transversely around bulkhead rings and riveted in place. These rings are of formed sheet alloy, or of formed extruded sections. Cutouts must be made in this basic fuselage structure to provide pilot and gunner cockpits on the upper side and on the under side, to provide a bombing hatch, bomber's observation window, and retractable-belly gun platform. This requires adequate bracing around such cut out sections of the fuselage, which brings into the structure numerous machined parts of extruded, cast or forged manufacture. Wings are covered with flat aluminum alloy sheet assembled over a structure built up of formed sheet alloy and various extruded, forged, and cast fittings and structural members.

Thus the basic structural strength of the entire airplane is in the flat sheet metal of the wing and fuselage surfaces, where inspection is almost automatic, and replacement or repair relatively simple. But beneath this skin there is a complex structural framework and system of controls, supports, and other parts of the plane that have been designed for machine production. Other major structural parts of the plane are its landing gear and engine mount.

The latter is a detachable structure of welded steel tubing, which is ideal for use where vibration and concentrated loadings must be carried. The landing gear is built of aluminum alloy sheet, castings and forgings, in conjunction with welded steel assemblies or other steel parts such as the axle, oleo cylinder and retracting gear.

In designing the Vultee attack-bomber it was necessary to give consideration to three general types of machine processing. This is in addition to such hand machine work as riveting, drilling and grinding. First is the machine shop proper with all its forms of cutting operations. Second is the metal forming shop with presses and drop hammers and its application to forming of sheet metal shapes. Included in this same category is the power shear for cutting sheet stock, and the power brake for bending or pressing angles into flat stock, or forming corrugated stock for flat sheet. Finally, there is the profiling department. This is a new development, a shop where complex metal shapes are cut out efficiently through use of special machinery.

First design consideration was to eliminate all machining and processing possible. Therefore the wing and fuselage were both made of such form as to permit substantial use of flat, unformed alloy sheets, in simple shapes. The fuselage consists essentially of a number of cylinders and cones of true circular cross section. The result is a simple structure, easy to build and of approximately ideal aerodynamic form. Fuselage sections are assembled on rotating jigs, providing maximum accessibility during construction. Individual sections progress to a master assembly jig where they are mated to form the complete fuselage structure and this structure then progresses to the final assembly line where it meets other sub-assemblies, such as the center section, wings, tail, etc.

Except for the special bracing around the fuselage cut outs previously mentioned, the structure of the fuselage is entirely monocoque; that is, all strength is in the surface sheet material. The only bracing given the flat sheet metal is the circular rings; there are no connecting longerons except at the cut outs. These rings are disposed approximately every fifteen inches along the length of the fuselage, but vary in both size and construction. However, all of the rings are machine formed. Some are of flat sheet light-alloy stock and some are of extruded stock.

One advantage of the extruded sections is that needed thickness can be had at fitting points, joints, or points of attachment for sub-assemblies, thus permitting bolts to attach directly to the ring without provision of built-up fittings. This simplifies construction and also provides a more rigid and more serviceable structure, as there are fewer parts to develop wear or misalignment.

Supplementary fuselage structures consist of the upper and lower bracing around the cut out portions of the structure. On the upper part of the fuselage this bracing consists primarily of simple longerons to distribute stresses fore and aft. At the lower side of the fuselage a more

complex structure is involved in order to provide for the wing mounting, the concentrated loads of bombs carried, and for emergency landings on the belly, requiring a heavy skid structure to protect the wing from damage. This problem is met by incorporating into the plane a subassembly which looks, when seen alone, somewhat like a sled. The two side members consist of heavy beams running fore and aft, joined and stiffened laterally by a number of sheet metal cross members.

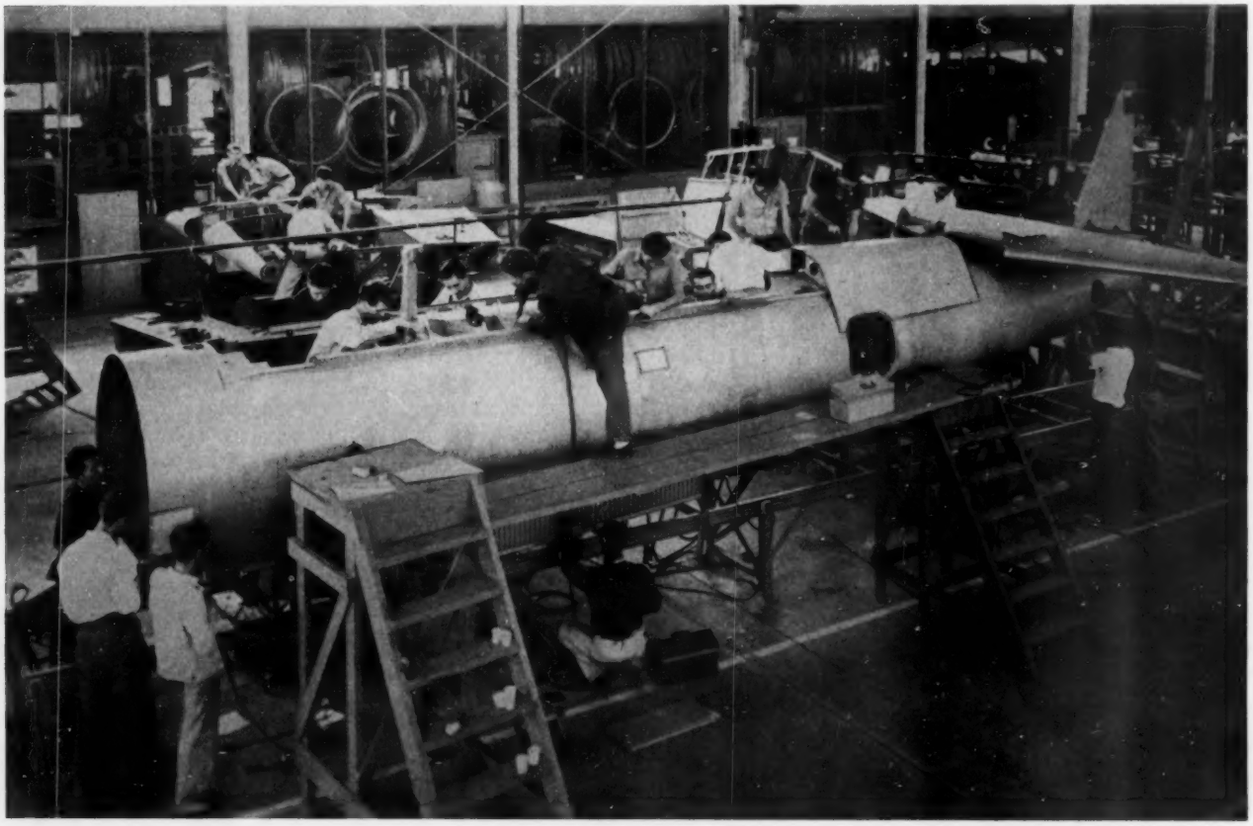
These cross members are formed in the drop hammer while the webs of the fore and aft beams are of corrugated sheet material formed in a vertical brake. Extruded section cap strips are used top and bottom along these fore-and-aft beams. Throughout the structure are numerous cast or forged aluminum alloy fittings at joints or points of attachment of secondary structures or sub-assemblies. All of this requires a great deal of machine work before the complete "belly sled" can be assembled into a single unit.

Machining plays a major role in the assembly of the wing proper, despite the relatively generous use of flat sheet material. For example a long saw-tooth alloy sheet gusset is used to reinforce the attachment of the wing spar to the surface material. This flat sheet gusset is of complex plan form, but this form is easily produced through use of the profiling machine, which will be described in a later article. Many of the wing ribs are formed on the drop hammer, a machine operation, and others are built up largely from extruded sections, which are machined and drilled at various attachment points.

Numerous machined small castings are used in the wing at points of attachment of controls, pulleys and ailerons. The leading edge of the wing, forward of the spar, is made detachable in sections by means of machined fittings and machine screws. This permits quick removal of the entire forward part of the wing for inspection or repair of the leading edge, which is more susceptible to damage, or of the wing proper. Machined parts are used more in the wing center section than in any other major part of the structure. It is this portion of the plane that must carry the most concentrated loads, such as fuel tanks, the landing gear, and the bomb load.

The machine processes which have been mentioned in connection with the basic structure of the Vultee wing and fuselage do not represent the major part of the machine work done in connection with the manufacture of this plane. But they do represent the most significant application of machining to the design, for they show a further use of machine processing than has heretofore been made. The machining which has been used in connection with manufacture of the basic structure of this plane has made it, we believe, typical of the airplane of the future; and especially typical of such "mass production" designs as we may evolve in the aviation industry to meet emergency needs for large numbers of planes when they are required within a limited time.

As has been mentioned previously, we like to stress the value of machine production methods from the standpoint of maintenance in the field. Machine shop production drawings speak a universal language. We can ship our planes to many quarters of the globe, as we have done in recent years, and feel confident that workmen, whether Oriental or European, Russian, Turkish, Spanish, or English, will be able to remove damaged or worn machine-made parts and easily reproduce them in their own shops.



Unit assemblies are brought together at this assembly station in the Vultee plant. Use of machined parts facilitate the final assembly operation and insure rapid maintenance of the plane after delivery

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DETROIT MICH.

Fixture Spring Jacks

Two simple calculations give proper angle and force to be applied by clamp screw in typical spring-jack design

W. A. LILLEY, JR.
Instructor in Machine Design
Drexel Evening Diploma School

SPRING jacks find use in many milling fixtures where rough work is to be supported and where there is much distance between fixed points of support. When properly functioning, the jack pin automatically should locate itself against the rough surface of the work when the piece is being placed in the fixture. Once positioned, it should be possible to lock the pin quickly and securely in position without moving it relative to the work.

A typical spring jack assembly is shown in Fig. 1. Here, the jack pin *A* is supported by a light spring *B*. It is restrained from rotating and limited in its vertical movement by the dog-pointed set screw *C*.

The pin *A* has a flat surface milled at an angle on one side, against which the auxiliary pin *D* is forced by means of a screw *F*. The dog-pointed setscrew *H* prevents this pin from rotating but permits longitudinal movement. The end of pin *D* is milled at the same angle as the flat spot on the pin *A*.

Hole *K* is provided to permit the escape of chips that enter the hole for pin *A*. When the cut has been made, the work is removed and screw *F* is loosened. The pin *A* then moves upward until the end of the keyway meets the dog point of the screw *C*. When the next piece of work is placed in the fixture, the pin is depressed by the work. Screw *F* then is tightened to hold the jack pin in the position which it assumes against the work.

The question is: What should be the angle of the milled surface on the side of the pin? If this angle is too large, tightening the screw *F* will push the pin upward and throw the work out of position. If the angle is too small, an extra heavy load of the cutting tool may force the pin downward, thus permitting the work to move out of proper alignment. Also, the smaller the angle the greater the load required on the screw *F* to prevent the downward movement of the pin. The calculations that follow lead to a selection of the correct angle.

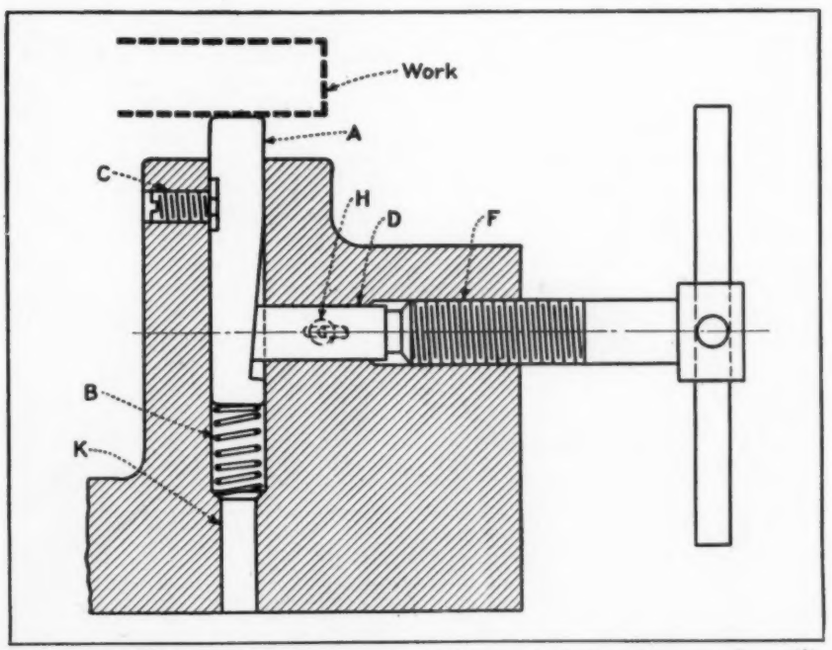


Fig. 1—Calculations for correct angle of flat on jack pin A are made easily. Many milling fixtures use such pins to support rough surfaces

Calculation for Maximum Angle

The angle should not be so great that tightening the screw *F* will tend to move the pin upward. Referring to Fig. 2, *N* represents a normal force applied to the pin *A* by the pin *D*, the latter being forced by the screw *F*. N_1 represents the normal force against the opposite side of the pin. μ is the coefficient of friction and α the angle to be determined. No external force is to be applied to the top of the pin to prevent its movement upward. Should the pin tend to move upward when the screw is tightened, its movement will be resisted by the friction μN_1 acting straight downward and the friction μN acting downward along the sloping milled surface of the pin. We then have four forces holding the pin in a state of equilibrium: N, N_1, μN and μN_1.

Taking the algebraic sum of the vertical components of these forces:

$$N \sin \alpha - \mu N \cos \alpha - \mu N_1 = 0$$

Taking the algebraic sum of the horizontal components of these forces:

$$N \cos \alpha + \mu N \sin \alpha - N_1 = 0$$

Finding the value of N_1 in the first equation and substituting in the

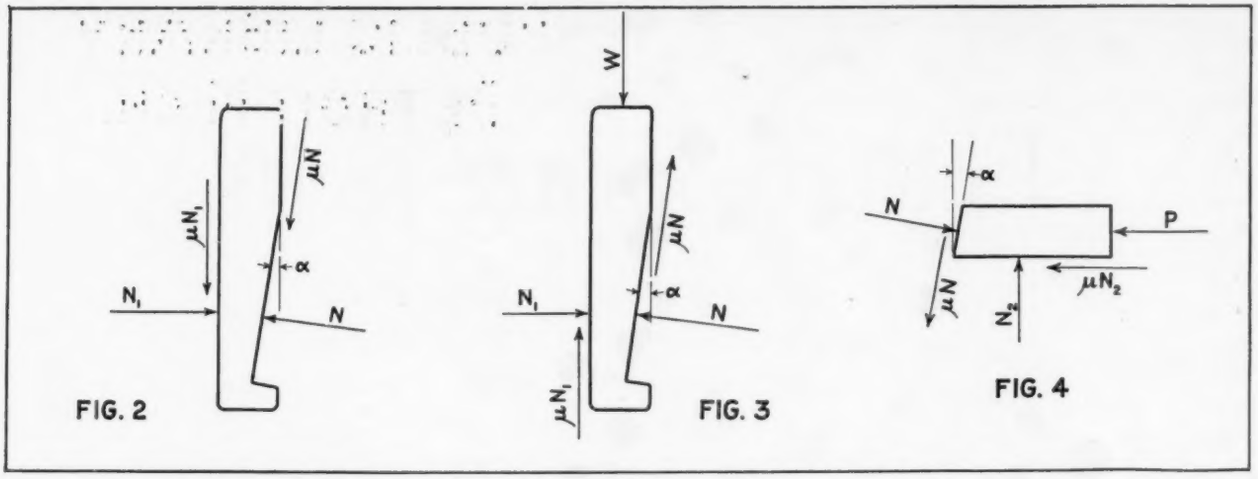


Fig. 2—Normal forces acting on an unloaded pin when screw F is tightened are indicated. Forces exerted on pins A and D when a load W is applied are shown in Fig 3 and Fig. 4

second and solving for the angle we have:

$$\tan \alpha = \frac{2\mu}{1 - \mu^2}$$

From this it is evident that the angle to be used is limited by practical values of the coefficient of friction. Assume that for smooth metal surfaces dry μ varies from 0.10 to 0.30 and, for smooth metal surfaces lubricated, μ varies from 0.05 to 0.08. Using the formula derived above and solving for the angle, we find that:

When: $\mu = 0.10$, $\alpha = 11°\ 25'$
When: $\mu = 0.08$, $\alpha = 9°\ 9'$
When: $\mu = 0.05$, $\alpha = 5°\ 45'$

The next step is to determine the force P that must be applied to the auxiliary pin D to resist a load W applied at the top of the jack pin A. Since the tendency to motion of the pin A is downward, the forces of friction will oppose this and will be upward. Since the tendency is to push the pin D to the right, the forces of friction will oppose and will be to the left. Fig. 3 and Fig. 4 show all the forces involved and their directions. Solving for W in Fig. 3 and for P in Fig. 4, and combining results to eliminate N, we have:

$$P = W\left[\frac{(1 - \mu^2) - 2\,\mu \tan \alpha)}{(1 - \mu^2)\ \tan\ \alpha + 2\ \mu}\right]$$

Applying the coefficients of friction which were assumed and their corresponding angles, the results are:

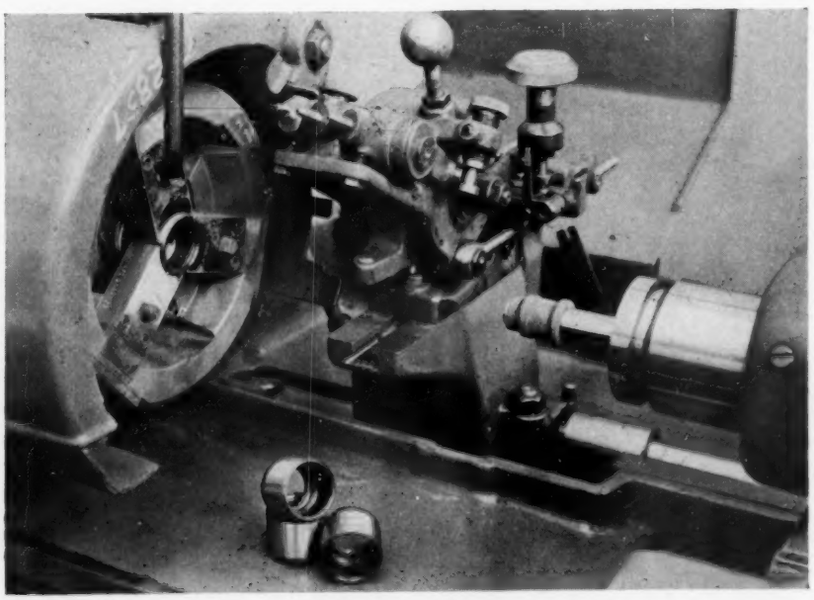
When: $\mu = 0.10$, and
$\alpha = 11°\ 25'$, $P = 2.38\ W$
When: $\mu = 0.08$, and
$\alpha = 9°\ 9'$, $P = 3.02\ W$
When: $\mu = 0.05$, and
$\alpha = 5°\ 45'$, $P = 4.92\ W$

From these calculations, it will be noted that the screw must apply a resisting force which is several times as great as the working load applied at the top of the jack pin. On account of the mechanical advantage of the screw, however, it will not be difficult to select one suitable for the job. For average conditions, an angle of 9 deg. should be satisfactory.

Three-Step Wheel Grinds Bores Simultaneously

IN THIS set-up for grinding three concentric bores in drill chuck sleeves on a Heald "Size-Matic" internal grinder, all three diameters are ground simultaneously, by means of a single three-step wheel, in an automatic cycle with automatic size control. These sleeves have three lands which are ground to 1.788, 1.749 and 1.563 in. in diameter, respectively, all within 0.001 in. size tolerance. Approximately 0.010-0.012 in. of stock is removed from each surface. Round tolerances are held within 0.0003 in. and concentricity of the bores to the outside diameter within 0.0005 in.

The grinding wheel has three steps as shown. All three are trued automatically in the cycle and at the same time by means of a triple diamond truing device. Each of these diamonds has individual micrometer adjustment for size control of each step. The table has a positive stop.



In this set-up each truing diamond has individual micrometer adjustment

Bought second-hand at a scrap-iron price, this old timer was kept in service from last century to just a few years ago

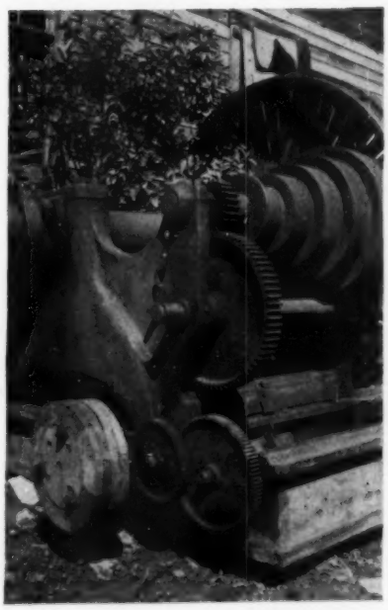
A Veteran of the Shop

FRED H. COLVIN

PIONEER railroading and early machine tools had much in common as illustrated by the old lathe shown herewith. I found it reposing in a vacant lot together with a man who thought he knew its history. But after finding the owner of the lathe, now retired, I got a very different story. All of which goes to show how easy it is to write history that isn't so.

The old owner, C. E. Johnson, came to Orlando, Florida, in 1886, after working at the Farrell Foundry in Ansonia, Connecticut, and the Sargent Company in New Haven, part of the time, at least, as a pattern-maker. The old South Florida railroad, which afterward became part of the Plant system (now the Atlantic Coast Line) was then a short, narrow-gage line with no shop facilities to speak of, and Johnson started the South Florida Foundry Company to handle major repairs.

There was great need for a lathe large enough to turn driving wheels; having missed two opportunities to buy a used lathe, they wired for one advertised in the *Manufacturers Record,* buying it sight unseen. It came from a New Hampshire shop and had seen considerable service, but was in use up to within a few years ago, handling a lot of large work for saw mills as well as for the railway. The cost of the lathe, as Mr. Johnson recalls it, was two cents a pound, plus freight, which seems like a real bargain.



Design details showing "air-cooled" gearing, "back" gears at the front and the engine-type thrust bearing and bearing cap

A study of the lathe shows many interesting contrasts in design and construction. It was built by the Industrial Works, Bement & Daugherty, in Philadelphia and has No. 37 cast into the tailstock base. The faceplate is 72 in., and there is a six-step cone with back gears. The tool carriage is what Prof. Sweet used to call the "corncob" design on account of its being built up high and its lack of stability. All the cross feed is in the tool block, though the whole carriage can be shifted across the saddle of the main carriage.

It will also be noted that the rack is set vertically against the bed and between the bed and the outer rail. This involved the use of bevel gears in the carriage apron to make the pinion mesh with the rack.

The "back" gears were in front and below the cone. The back-gear shaft was moved endwise to bring the gears into or out of mesh. Two grooves near the outer end of the shaft permitted the half collar formed in the lever shown in a vertical position, to hold it at either position. The feed pulley was lagged with wood sections to increase its diameter and reduce the feed.

Of interest is the type of thrust bearing shown between the upper feed pulley on the back end of the spindle and the headstock. This is more like a gland packing of steam-engine practice. The bearing cap also reflects steam-engine practice. The faceplate is driven internally by a pinion. Greater contrast with modern lathe construction and rigidity would be hard to imagine.

About Face

The much talked-of Toledo Plan is described by one who had much to do with its initiation and successful operation

R. E. CARPENTER
Vice-President, Spicer Manufacturing Corporation

IN THE spring of 1934, Toledo entered into a period which gave it the name of a "plague spot" in the industrial relations of this country. The great Auto-Lite strike, with its mass picketing, rioting and final use of the state militia, gave the northwestern Ohio city a notoriety which threatened its future.

A violent strike in the 2,000-man plant of the Chevrolet Motor Company in Toledo occurred in the early part of 1935. It proved a threat to Chevrolet's entire production, as it choked the company's supply of transmissions. A power strike followed in June, and Toledo hit the bottom of bad feeling and discouragement.

With production problems of their own, Detroit automobile manufacturers let it be known that they had little tolerance for Toledo's condition. The city was under continual threat of removal of motor parts business. One big Toledo manufacturer of automotive equipment was pressed into building a $1,000,000 auxiliary plant in a distant city.

McGrady's Suggestion

Then, over three years ago, something happened to Toledo. Edward F. McGrady, then the able first assistant secretary of the U. S. Department of Labor, and now vice-president of the Radio Corporation of America, in Toledo at that time to complete a power strike settlement, took the initiative in suggesting what has become the "Toledo Plan for Industrial Peace."

The McGrady plan was not accepted enthusiastically at first by strong partisans of either capital or labor. Notwithstanding, it provided a leaven to the community which started to work immediately. Gradually, during the last half of 1935, the world began to hear a brighter story of Toledo.

That Toledo had any kind of industrial peace under any plan, that the community was actually taking a part in protecting itself against disorder, got about the country by word of mouth and through the press services. "Can you give us the details of your peace plan?" was the theme of hundreds of letters that began to pour into city and newspaper offices and to be received by private individuals.

City-Manager Government

Within the life of the Toledo community, the peace plan was gathering support. Toledoans expressed again their new-found courage on January 1, 1936, when they inducted into office a city manager-nine man council form of government and left its administration in the capable hands of John N. Edy, career man in municipal government.

Now, after the era of sit-down hysteria in other cities, Toledo is no longer in disrepute among American industrial cities. It is in a position to look out upon the scene with a kind of earned self-respect.

To get back to 1935, it was the feeling of Toledo industrialists that Toledo had been libeled in the eyes of the outside world. Misconceptions had to be corrected. Facts about Toledo's peace board and new city government had to be widely disseminated, particularly in the Detroit area. Thus was conceived the Toledo Associates, an organization unquie in the field of press relationships formed to tell the story of Toledo. In nowise a pressure group, Toledo Associates simply establish a clearing house for Toledo's civic, industrial and labor news.

The job was divided into four general classifications—regular "spot news" releases, feature articles, special bulletins and personal contacts—and results were soon apparent in the large number of clippings received daily from leading bureaus. Other cities beset by problems similar to Toledo's welcomed this news in an effort to improve their own situation. Eventually a number of feature articles appeared in influential periodicals.

This barrage of national publicity has an important secondary effect at home. It is one thing to read about your city in a local paper; but it is more convincing to hear the home town's praises sung in the pages of outside periodicals of national reputation. These outside efforts convinced Toledoans that their city was an example to the nation at large, and increased their own civic pride.

Granted that Toledo was on the high road to recovery with comparative labor stability and business-like city government, members of Toledo Associates quickly realized that there are no periods, only commas, to the punctuation of labor disputes in times of returning prosperity and industrial expansion. With a headstart on those communities which had not absorbed their labor experience the hard way, Toledo industrialists felt it advisable to develop certain public relations projects to preserve the harmonious *status quo*.

Specific Projects Sponsored

At first, there was considerable support for adoption of a community program developed by national organization, but the final decision was that Toledo Associates should sponsor specific projects from time to time that would increase cooperation among all groups in the city. Members wished to avoid that bugbear of civic movements—the let-down that invariably follows the first fine burst of enthusiasm. If a permanent program was to be developed it should come step-by-step through trial-and-error, rather

than with one big splurge whose ripples rapidly die away.

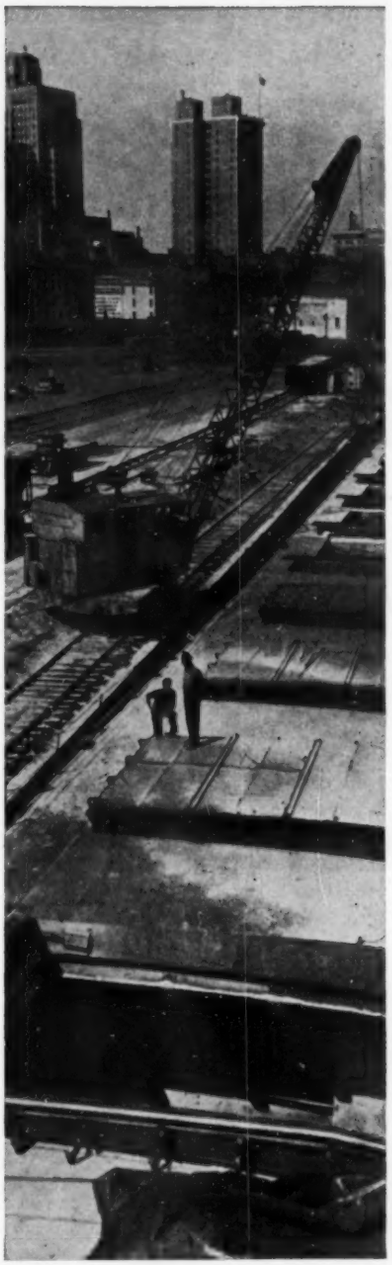
Parts of the campaign of the National Association of Manufacturers were put into active service. Billboards, sound-slide films and booklets were used. Another significant effort was cooperation with a local newspaper in a new presentation of industrial news.

Feature articles were published on subjects close to the employee pocketbook: how research creates jobs, what auto parts mean to Toledo, effect of diversification on steadiness of employment. Shorter stories and pictures of men who have served their industries for many years filled out the space. Result: a newsy page that was studied and read. This is the sort of effort which over an extended period of time and in a legitimate way, can do much to create a better understanding of industry.

Research Makes Work

In addition to this series of biweekly industrial pages, several surveys have been made by Toledo Associates on timely industrial subjects. Although they received wide attention elsewhere, they are primarily intended for local consumption. Research, again from the worker's angle, was put under the microscope in a study of local industries. A prevailing theory has been that industrial research was aimed primarily at the development of labor-displacing machinery. On the contrary, a statistical survey by Toledo Associates showed that research carried on by six Toledo industries created 6,000 new jobs between 1929 and 1936. Libbey-Owens-Ford Glass Company provided an interesting case history. Its business is divided between building glass and automobile safety glass. When the building market collapsed, safety glass, perfected by research, stepped in to provide 2,000 jobs. Today it is standard equipment on every car and Toledoans have a new industry that didn't exist in the twenties.

Another survey just completed endeavors to present a joint community financial statement. Eight large companies cooperated with Ernst & Ernst, certified public accountants, in supplying and compiling data. It showed an average investment of $4,219 in machinery, plants and equipment per employee last year. These eight typical Toledo industries had 34,870 employees on payrolls and 30,782 stockholders, as compared with 15,715 and 17,910 respectively in 1929, regarded as a peak of industrial activity. Even in terms of the larger number of jobs, real wages advanced about seventeen per cent.



Toledo's busy waterfront reflects the city's industrial peace

Such information presented in an honest, factual manner is sure to secure a sympathetic hearing. Effective public relations call for facts and more facts, whole-truths as compared with half-truths.

All the confused thinking that has been going the rounds since 1934 and 1935 has had one effect which is important in any community educational job; it tends to limit the sphere of any organization's influence to its own immediate group, thus preventing it from doing a community job.

In Toledo, the Foremen's Club has grown in numbers and influence, so that it should quickly assume a position of greater influence in industrial affairs. What is true in Toledo doubtless applies to Detroit, Flint, Syracuse and other centers.

Foremen occupy a strategic position. They stand between management and labor; they can interpret one to another. Not branded as partisan, they are in a position to champion industrial peace and sponsor in their local communities, programs to further this end.

The Toledo Associates have cooperated with the Foremen's Club wherever possible. They have helped secure outstanding speakers for their meetings. Copies of "Today in Toledo," a little Toledo Associates house organ, have been distributed at Foremen's meetings. There has been some talk of forming an industrial speaker's bureau, different from the usual run of speakers bureaus.

Centennial Celebrated

The supper held to celebrate Toledo's Centennial in September, 1937, perhaps is the most significant single project in which the Toledo Associates participated. More than 2,500 Toledoans gathered in the new $1,000,000 United States Naval Armory for a real church-variety community supper embracing the whole city. Mr. McGrady, General Hugh Johnson and John D. Biggers, president of the Libbey-Owens-Ford Glass Company, made addresses which sent guests home with a fuller appreciation of their city. Labor leaders sat by business executives. It was an inspired occasion which put Toledo in a courageous frame of mind for its second hundred years.

Our experience in Toledo has shown that openness and honesty are the basic ingredients in any community program. Steer a factual course and stick to it. Sell your policies as you would your products—with imagination.

William A. Thomson of the American Newspapers Publishers Association said:

"And yet, there stands business, like some unhappy patient cow in the stable, expected to produce morning and evening milk, without fodder and with no reward other than a kick in the tail after every milking.

"Surely, after continued contemplation of this sorry spectacle, the united voice of business must arise, determined to make its case clear and to organize the mighty forces of public opinion behind it."

Toledo is well satisfied with its start in this direction.

Chip Breakers For Stellite Tools

Proper breaking and removal of chips is principally a problem of grinding the tool to suit governing conditions

E. F. SMITH
Haynes Stellite Company

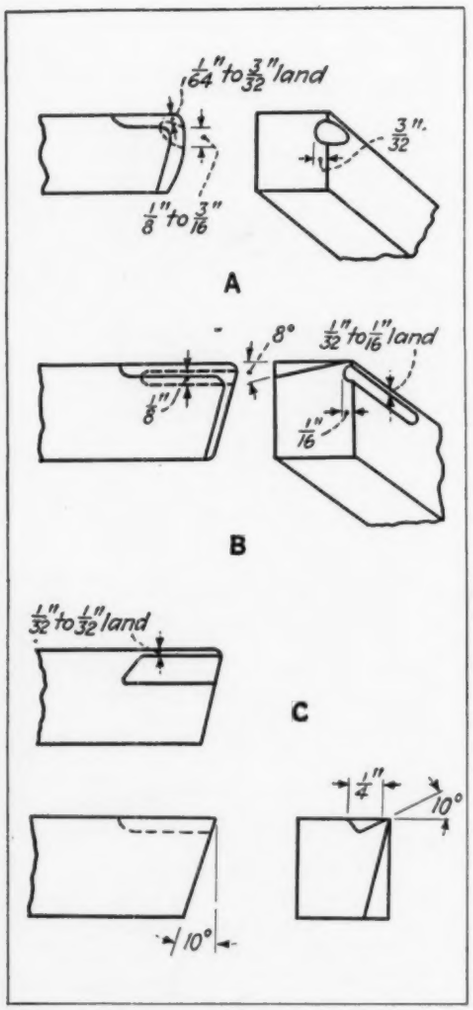


Fig. 1—A simple notch ground in the tip of the tool, as at A, often is all that is necessary for chip control. Other applications require a long, narrow groove, as at B. A modified groove, shown at C, gives increased lip strength

CHIP REMOVAL is not a problem in the machining of such materials as cast iron, where the chips break up readily, and steel, where the operator is protected by a metal guard, if the chips do not interfere with the operation of the machine. However, the need for machining tough alloy steel castings and forgings has made imperative some means of breaking up continuous chips on a number of operations.

Continuous chips which do not form a spiral a few inches in diameter, or long spiral chips which are not easily broken because of their springiness, are a nuisance as well as an accident hazard. They cause undue wear on tool-holders and fixtures; they may mar the finish of the work; they are difficult to remove from the machine during cleaning; and, most important of all, they threaten the safety of the machine tool operator. Fortunately there are remedies for these conditions, including factors ranging from slight adjustments in cutting speeds or feeds to specially designed mechanical chip breakers.

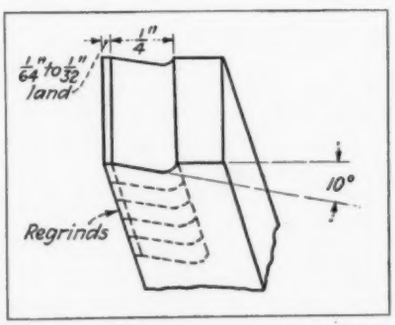


Fig. 2—End-cutting tools have a groove across the top. Since the edge is well supported, land can be narrower than for side-cutting tools

Angles of tool grinds, particularly on the top slope, are the most important factors the operator, set-up man and tool grinding department have under their control. They usually cannot choose the material from which a part is to be made solely for its machinability, nor is it advisable to change speeds and feeds on a job known to be giving the most economical balance between tool cost, production time and finish required. The tool grind, if it can be altered slightly, is the next best solution, although it is determined principally by other factors than the breaking of chips.

On finishing operations, the chip is usually so thin that it presents no problems. Chips taken with less than $\frac{1}{8}$ in. depth of cut seldom cause serious trouble. In most cases, it is a simple matter to grind rake angles so that the chip will be curled back against the work and will break off there. However, there are many operations where scratch marks left on the work from the action of the chip are undesirable.

In most instances, notching or grooving the Stellite-tipped tool is sufficient to break up undesirable steel chips. The plain notched lip often used is shown at *A* in Fig. 1. Here, a notch is ground into the top of the tool approximately 3/2 in. deep at the end of the tool and $\frac{1}{8}$ to $\frac{3}{16}$ in. wide at the widest point, tapering into the top surface of the tool for a length depending upon the depth of cut. The width of the flat land left between the notch and the cutting radius varies from $\frac{1}{64}$ in. to $\frac{3}{32}$ in., depending on the depth of cut, hardness of the material and feed per revolution.

The grooved-lip type of chip breaker is probably used as often as any of the other grinds for breaking chips. Here, as indicated at *B* in Fig. 1, the groove is made $\frac{1}{16}$-in. deep with a $\frac{1}{8}$-in. cutting-off wheel. It is cut parallel to the cutting edge of the tool. Stellite-2400 and J-Metal tools used with a land as narrow as $\frac{1}{32}$ in. have operated successfully in cuts as deep as $\frac{3}{4}$ in. However, at least $\frac{1}{16}$-in. land width is usually recommended for heavy work. On some jobs grooves combining those shown at *A* and *B* have proven most satisfactory.

In many cases, this groove can be modified slightly with better results. The modification, shown at *C*, is essentially a change in the profile of the groove, with a 10-deg. angle between the flat groove surface and the top flat surface of the tool. Tools ground in this manner have proved good for use on steel turning operations, and are found to have greater lip strength than tools ground with radius lips. The speed at which Stellite-2400 or J-Metal can cut steel with this type of grind ranges from 120 to 250 ft. per min., with a feed of from 0.0075 to 0.050 in. per rev., depending upon the tensile strength of the steel being machined, the depth of cut, rigidity of the work and the finish required.

Fig. 2 shows an end-cutting turning tool grooved across the top. This groove is essentially the same as that shown at *C* in Fig. 1, but the width of the notch here is $\frac{1}{4}$ in. and, because of the excellent support for the cutting edge, the land width is narrower, ranging from $\frac{1}{64}$ to $\frac{1}{32}$ in. Width and angle of the notch determines the length and curl of the chip. As a general rule, a 10-deg. angle as shown has been found satisfactory.

These methods of notching or grooving the tool are adaptable to either solid tool bits or welded-tip tools, and are recommended generally. In some cases, usually determined by actual cutting tests, slight modifications or combinations of these grinds will help individual operations, but, as presented, they will give excellent tool life on most operations.

The use of a groove for curling the chip from an end-cutting tool is illustrated in Fig. 3. Turning tools on similar operations have been reground with this type of groove until both groove and land have been carried down as far as $\frac{3}{4}$ in. from the original top of the tool. The back shoulder of the tool was not ground during resharpening, and, consequently, it breaks up the chips effectively. A long, continuous coiled chip as shown happens to be permissible on this type of machine, but there are many operations where a coil would be undesirable, especially on automatic machines where it might impair the proper operation of the machine.

When the proper curling or breaking of chips cannot be feasibly accomplished by means of grooving or notching the top of the tool, it is usually possible to use a simple chip breaker in the form of a shim clamped on top of the tool in the holder. Usually the chip breaker shims are made of S.A.E. 3140 or S.A.E. 6145 steel. The proper contour to curl the chip is dependent upon how and where the chip can be disposed of on the particular machine. It is best determined by the cut and try method, and is dependent on the clearance angles on top of the tool the width and depth of cut taken, and the type of steel machined. After the end contour of the chip breaker shim has been determined, the end is hard-faced to prevent wear and maintain the contour so that the chip is always properly directed. After hard-facing, the shims are heat-treated to resist the wear of the screws used to hold the tool and the chip breaker shim in the holder.

Grooved Block Used

On one turning job, such a chip breaker was made from a block of steel with a groove starting on the side and running out on the top. At its mouth, the groove was cut $\frac{3}{4}$ in. wide. This block, when secured about $\frac{3}{8}$ in. back of the cutting point of the tool, broke the chips in lengths of about $2\frac{1}{2}$ in. Frequently on production operations, hard-faced breakers are fastened directly to the tool blocks with set screws or dowel pins, to obviate the need for resetting the breaker with changing tools.

For boring, similar grinds can be used if there is sufficient room to allow for chips to curl and break, but if the chips might damage the work and are so tough that they do not break, a more drastic grind is necessary. Fig. 4 shows a boring bit which is successfully employed for boring S.A.E. 6140 steel bearing retainers. At a surface speed of 140 ft. per min., a feed of 0.020 in. per rev., and a depth of cut of $\frac{1}{4}$ in., this grind was found to be the only feasible method of chip disposal. As a result, it is used on all the boring operations in one plant. A set-up using a similar tool bit for boring a S.A.E. 6135 steel bushing is shown in Fig. 5. Here the chips are curled and broken by a shoulder.

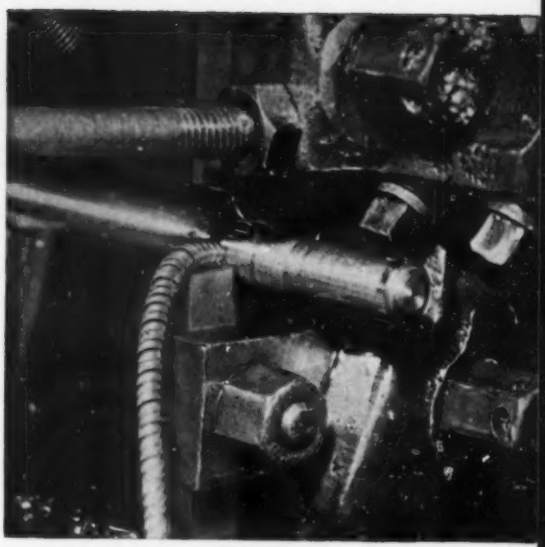


Fig. 3—This chip was produced when turning a Nitralloy water pump shaft with a solid Stellite J-Metal bit having a groove like that in Fig. 2. Depth of cut was $\frac{3}{32}$ in., feed was 0.0078 in.

Fig. 4—By grinding this tool bit as shown, chips were broken up properly in boring bearing retainers from S.A.E. 6140 steel

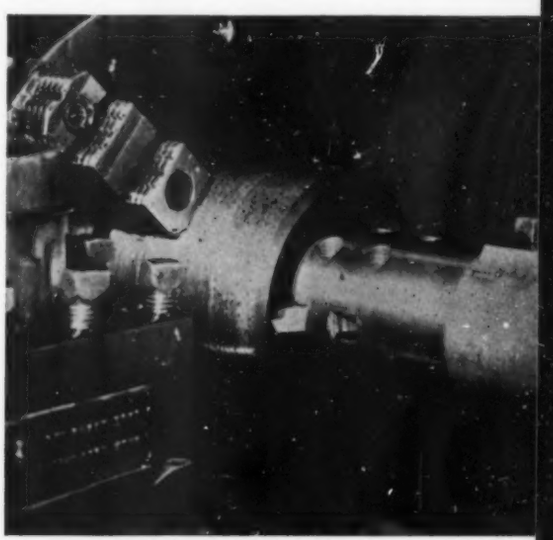


Fig. 5—Chips formed when boring this S.A.E. 6135 steel bushing were easily curled and broken by the shoulder on the boring bit

IDEAS FROM PRACTICAL MEN

Milling Half-Round Ends

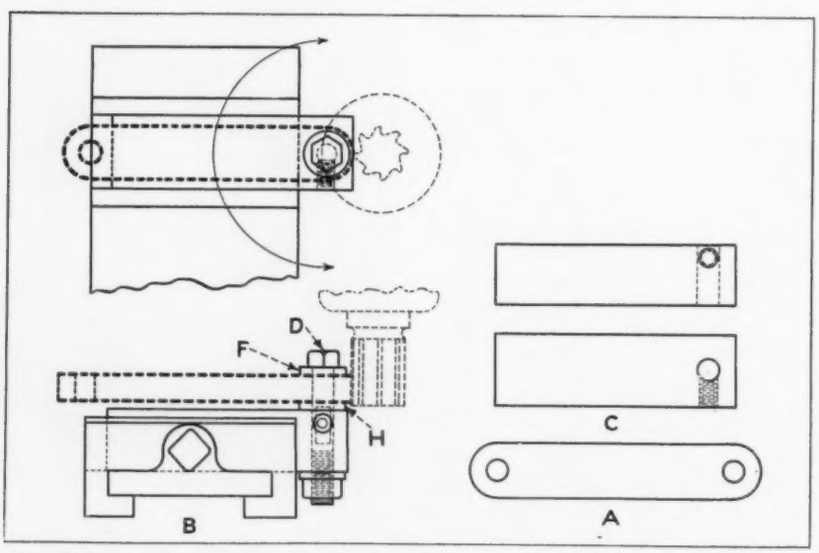
JOHN W. GERDEL

Several jibs were being built, each of which was to have a number of $\frac{1}{2}$ x 1-in. cold-rolled steel levers like the one shown at *A*. The specifications called for the ends of the levers to be rounded concentric with the $\frac{3}{8}$-in. holes as indicated.

The set-up for milling these ends was very simple, as can be seen at *B*. A $\frac{3}{8}$-in. clearance hole was drilled in the cast-iron block *C* for the hex-head capscrew *D* and another hole was drilled and tapped for a set-screw. The capscrew was put through the finished washer *F*, through one of the holes in a lever and through the finished washer *H*. It was then put through the clearance hole in the block and a washer and a nut were put on its lower end. A setscrew was put in the tapped hole in the block and screwed lightly against a flat filed on the body of the capscrew. The nut on the lower end of the capscrew was tightened to create quite a stiff resistance against rotating the lever and the setscrew was tightened against the capscrew to prevent it from turning.

The whole assembly was held in the vise of a vertical milling machine, in the spindle of which was an end mill. After centering the lever with the spindle of the machine it was fed to the side of the end mill for a light cut on the end. Then the lever was pulled by hand around the capscrew as a center. Successive light cuts were taken in the same way until the end mill almost touched the sides of the lever when it was pulled to 90 deg. either side of its central position.

The ends of all the levers were milled by the same method and were afterward smoothly finished with a file and abrasive cloth.



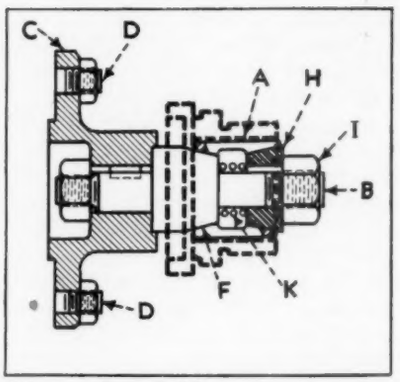
The holes in the levers serve as pivotal points in swinging them by hand around a capscrew in a block held in the machine vise

Fixture With a Floating Clamp

J. R. WHITTLES

Having read with interest the article by William B. Greener under the above title (*AM*—Vol. 82, page 935), I think a more satisfactory method in grinding the work would be to hold it on a mandrel having an expansion sleeve, thus eliminating the objectionable overhang and the loose, floating C-washer illustrated in Mr. Greener's article.

Referring to the accompanying illustration, the work, indicated by heavy dotted lines, is located on the expansion sleeve *A* on the mandrel



The work is held on an expansion sleeve slidably mounted on a mandrel held in a bracket attached to the face-plate of the machine

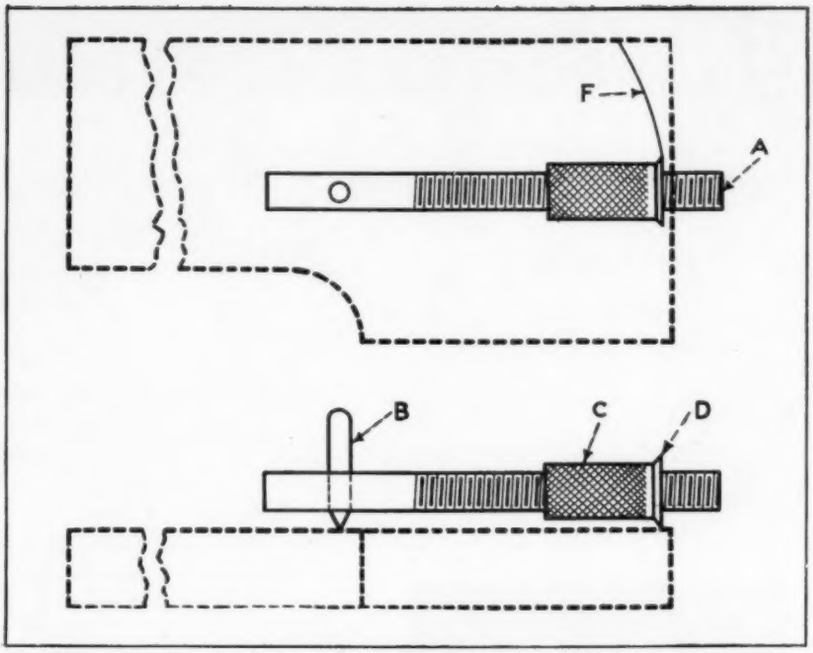
B which is held in the bracket *C*, the bracket being piloted on the face-plate of the machine and secured thereon by bolts *D*. The tapered collar *F* is an integral part of the mandrel and the tapered bushing *H* is a sliding fit thereon. The expansion sleeve is internally tapered at both ends, so that when nut *I* is tightened it pushes the taper bushing into the taper in the outer end of the expansion sleeve and, in turn, pushes the taper in the inner end of the sleeve onto the tapered collar, expanding the sleeve in the bore of the work.

When nut *I* is backed off spring *K* releases the tapered bushing from the outer end of the expansion sleeve, permitting the inner end of the sleeve to free itself from the tapered collar and to collapse as the work is pulled off.

Tool for Laying Out Cams on Clamping Levers

HAROLD E. ERICKSON

Several welding fixtures in course of construction required cam-faced levers for clamping the work to be welded, so we made the tool illustrated for laying out the cams. It consists of the threaded rod *A*; the pivot pin *B*; and the knurled nut *C*. The threads on the rod are 20 per in. and are an easy fit in the knurled nut which has a sharp edge on the end at *D*, 1.3745 in. in circumference.



As the nut revolves it also travels on the threaded rod, its sharp edge tracing a spiral line of the coppered surface of the lever

In laying out a cam, the lever is coated with copper by a solution of blue vitriol and water. Then a center punch mark is made at the shortest required distance from the face of the cam, and from it the short arc *F* is struck with dividers set to the minimum cam radius.

In use, the point of the pivot pin is placed in the punch mark and its upper projecting part is held by the thumb and forefinger of the left hand. The nut is adjusted by revolving it on the threaded rod until its sharp edge coincides with the beginning of the short arc. With its sharp edge in contact with the lever, the nut is revolved by passing the forefinger of the right hand over its knurled surface, causing its sharp edge to roll on the coppered surface and trace a fine line. Since, while the nut revolves it also travels on the threaded rod 0.050 in. per revolution, the line traced by its sharp edge is in the path of a spiral. In this case the divergence of the spiral line from a true arc gives the cam the same clamping effect as that of a wedge having an angle of 2 deg. 5 min., which is figured as follows:

$$\frac{\text{Circumference of sharp edge on nut}}{\text{Distance nut travels on rod in one revolution}} = \text{cosecant of the angle of divergence from a true arc.}$$

Therefore: $\frac{1.3745}{0.050} = 27.49 =$ cosecant of 2 deg. 5 min.

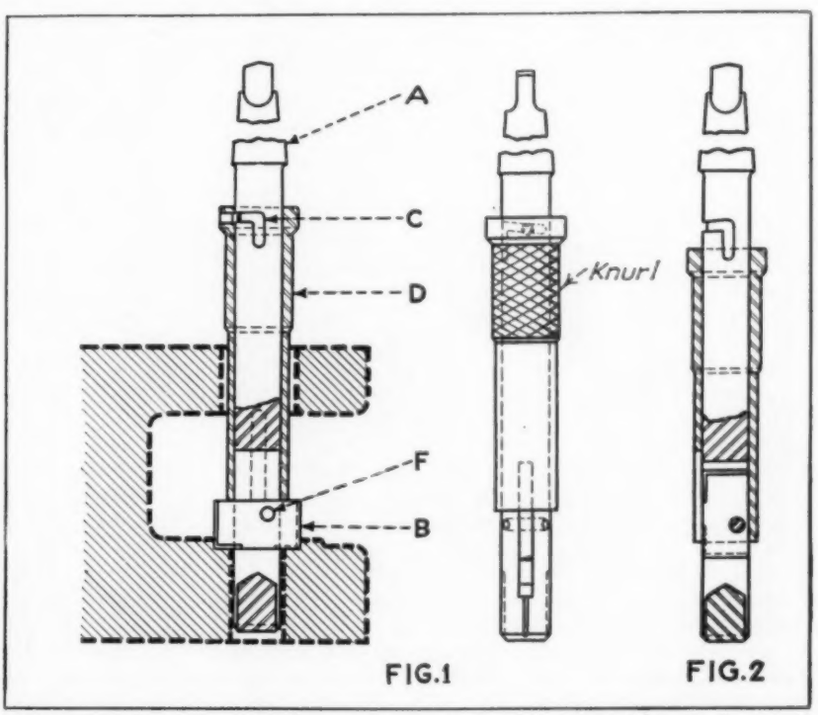
Counterbore for Inaccessible Places

EMIL WITTMANN

The counterbore illustrated has proved very satisfactory in inaccessible places. As shown in Fig. 1, the upper part of the shank *A* is tapered to fit the drill press spindle and its lower end is slotted for the cutter *B*. Just below the taper, there is milled the bayonet-lock groove *C*, the horizontal part of which is slightly helical. The sleeve *D* is a sliding fit on the shank. The upper part is knurled for a finger grip and the collar at its top is provided with a setscrew, the dog point of which engages the bayonet-lock groove in the shank. The lower end of the sleeve is slotted on one side to clear the cutter, which is pivoted off center by the pin *F* so as to be unbalanced.

Assuming that the lower hole in the work indicated by heavy dotted lines has just been counterbored, with the drill press stopped, the sleeve is turned to the right until stopped by the dog point of the setscrew contacting the vertical part of the bayonet-lock groove. That brings the slot in one side of the lower end of the sleeve in line with the cutter slot in the shank. As the spindle is raised, the cutter comes out of the counterbored hole and allows the sleeve to drop of its own weight and swivel the cutter into the position shown in Fig. 2, permitting the tool to be withdrawn through the upper hole in the work.

With the tool lowered through the next upper hole and the pilot engaging the hole to be counterbored, the sleeve is raised until the dog point of the setscrew contacts the horizontal part of the bayonet-lock groove,



Operating the sleeve in different ways permits the cutter either to drop and be locked in cutting position or to be withdrawn into its slot

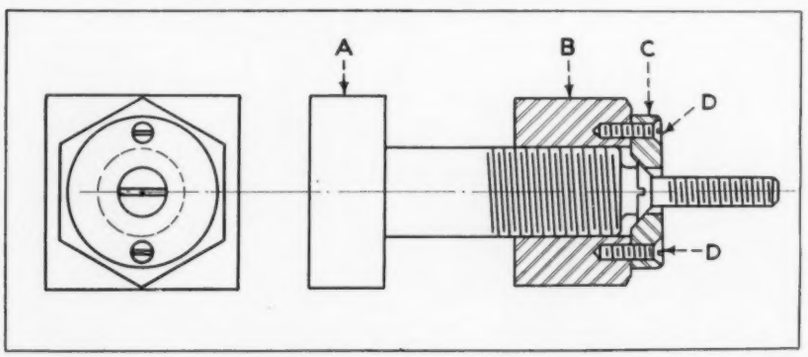
permitting the unbalanced cutter to swivel and assume the position shown in Fig. 1. A quarter turn of the sleeve to the left causes the dog point of the setscrew to ride on the horizontal part of the bayonet-lock groove and bring the slot in one side of the lower end of the sleeve out of line with the cutter slot in the shank and lock the cutter in position for counterboring.

Holder for Rethreading Machine Screws

W. M. HALLIDAY
Millfield, Peterborough, England

Referring to the article by John E. Corrigan under the above title (*AM*—Vol. 82, page 810), I feel sure that where appreciable turning effort has to be employed in rethreading the screws, the screwdriver point will be forced out of the slots. Especially when bar *C* is used farthest from the point of bearing will its spring weaken the hold on the screw. Another possible source of trouble is that the screw may be forced entirely out of its hole by end pressure in starting the die.

In the accompanying illustration is shown a screw holder designed by me, which has been in use for some time with good results. It consists merely of the square-head bolt *A*, preferably of tool steel; the hexagon nut *B*; and the cover plate *C* which is attached to the top of the nut by screws D. The threaded end of the bolt is turned down to a shoulder and on its extreme end is formed a



Prevented from turning by the screwdriver point, the head of the screw is clamped between the bolt end and the countersink in the cover plate

screwdriver point. The cover plate is drilled to admit the body of the largest screw to be held and its under side is countersunk for the heads of screws of various sizes.

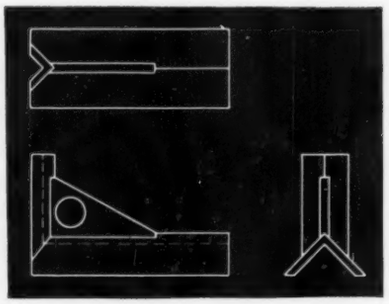
In use, the bolt head is gripped in the bench vise and a screw is placed so that the screwdriver point is in engagement with its slot. The nut is then passed over the body of the screw and is screwed down on the bolt until the head of the screw is clamped between the end of the bolt and the countersink in the cover plate.

Convenient Square

MARTIN H. BALL

Field repair work frequently requires hand drilling and tapping, and it was work of that type that led to the design of the small square illustrated, which has V-grooves in both its base and blade to increase its usefulness.

The square is made of low-carbon



V-grooves in the base and the blade of this 2½-in square are used to increase its usefulness

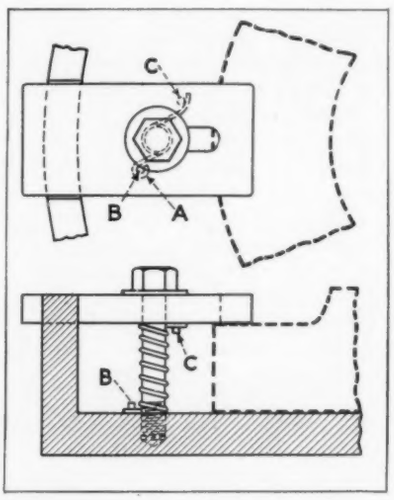
steel welded at the joints and has a central rib to give it rigidity. The hole in the rib is for convenience in handling. Both the base and the blade have a longitudinal V-groove. It is not hardened, since it is not well adapted for extremely accurate work, being only 2½ in. long. It is finished on the faces and ends and in the V-grooves, and is enameled on the outside.

This small tool is especially convenient for checking the squareness of tools for drilling and tapping where a drill press is not available, since it will indicate any out-of-squareness of the drill or tap from either a flat or a round surface, such as a bar or a pipe. The V-groove in the base aligns the square with the bar or pipe, while the V-groove in the blade when adjusted properly shows misalignment of the drill or tap in any direction.

Double-Action Clamps for Circular Fixtures

H. MOORE
Leeds, Yorkshire, England

In a large circular fixture equipped with twelve clamps, the clamps were held up by helical springs and their heels were let into their supports so they would be guided in sliding them back out of contact with the work, as shown in the illustration. The lower end of each spring had an eye formed in it, as at *A*, fitting over the pin *B* which was driven into the base of the fixture. The upper end of each spring had a straight tail which bore against the pin *C* in the underside of the clamp. In assembling the fixture to hold the work, the springs were wound up a couple of turns.



When the bolt is loosened the spring not only holds the clamp up, but its tendency to unwind forces the clamp back clear of the work

In operation, when the clamp bolts were loosened, the springs not only held up the clamps, but their tendency to unwind slid the clamps back clear of the work.

Time-Data Sheet No. 17

Milling and Profiling Time Data—I

PART:

Steel, brass, copper, cast iron, alloy, micarta, fibre and other materials.

OPERATION:

Mill and profile castings and raw material.

WORK STATION:

All horizontal and vertical (profilers) milling machines of the knee and column type in the East Pittsburgh Works of the Westinghouse Electric Manufacturing Company.

ALLOWED TIME FOR SET-UP:

Standard Hours = $0.1660 + 0.1430N + 0.0770A +$ (Table 1) $+ 0.0052C + 0.0740V + 0.0415D +$ (Table 2) $+ 0.0268E + 0.0178F + 0.0880G + 0.1860H + 0.0096K + 0.0074P$.

Where: N = Number of operations per job.
A = Number of arbors per job.
C = Number of additional cutters without spacers between (cutters in sets).
V = Number of vises per job.
D = Number of set-ups in vise per job (parallels, shims, stops clamped, etc.).
E = Number of first clamps and bolts per job—table set-up.
F = Number of additional clamps and bolts per job—table set-up.
G = Number of index heads per job.
H = Number of index tailstocks per job.
K = Number of times stops are set for table travel per job.
P = Number of times coolant pipes are set per job.

TABLE NO. 1—CUTTER CONSTANTS

0.0940 = Constant per end mill cutter in milling machine.
0.0970 = Constant per cutter in profiler.
0.1290 = Constant for one cutter with collars.
0.2630 = Constant for two cutters with collars.
0.3480 = Constant for three cutters with collars.
0.4590 = Constant for four cutters with collars.

TABLE NO. 2—FIXTURE CONSTANTS

0.0840 = Constant for small fixture.
0.0950 = Constant for medium fixture.
0.1660 = Constant for large fixture handled by hand.
0.2000 = Constant for large fixture handled by jib crane.
0.2030 = Constant for very large fixture handled by overhead crane.
0.1050 = Constant for small angle plate.
0.3130 = Constant for large angle plate handled by jib crane.

ALLOWED TIME FOR EACH PIECE:

When Using Fixture:

Standard Hours = (Table 3) $+ (0.0043 + 0.0003A_1 + 0.0004B_1 + 0.0005C_1 + 0.0061D_1 + 0.0120E_1 + 0.0048F_1 + 0.0033G_1 + 0.0055H_1 + 0.0013J_1 + 0.0055K_1 + 0.0022L_1 + 0.0034M_1 + 0.0048N_1 + 0.0113P_1 + 0.0175Q_1 + 0.0008R_1 + MT) \div X$

When Using Vise:

Standard Hours = (Table 4) + (Table 6) $+ (0.0077 + 0.0003A_1 + 0.0004B_1 + 0.0005C_1 + 0.0055K_1 + 0.0022L_1 + 0.0034M_1 + 0.0168V_1 + 0.0113P_1 + 0.0175Q_1 + MT) \div X$

When Piece is Clamped to Table or Angle Plate:

Standard Hours = (Table 5) + (Table 6) $+ (0.0033 + 0.0003A_1 + 0.0004B_1 + 0.0005C_1 + 0.0061D_1 + 0.0120E_1 + 0.0055K_1 + 0.0022L_1 + 0.0034M_1 + 0.0113P_1 + 0.0175Q_1 + 0.0084S_1 + 0.0022T_1 + 0.0168V_1 + MT) \div X$

When Using Index Head—Work Held Between Centers:

Standard Hours = $0.0111 + 0.0062T + 0.0003A_1 + 0.0004B_1 + 0.0005C_1 + 0.0055K_1 + 0.0022L_1 + 0.0034M_1 + 0.0113P_1 + 0.0175Q_1 + MT$

When Using Index Head—Work Held In Chuck:

Standard Hours = $0.0072 + 0.0062T + 0.0003A_1 + 0.0004B_1 + 0.0005C_1 + 0.0055K_1 + 0.0022L_1 + 0.0034M_1 + 0.0113P_1 + 0.175Q_1 + MT$

When Using Index Head—Work Held In Chuck and On Center:

Standard Hours = $0.0095 + 0.0062T + 0.0003A_1 + 0.0004B_1 + 0.0005C_1 + 0.0055K_1 + 0.0022L_1 + 0.0034M_1 + 0.0113P_1 + 0.0175Q_1 + MT$

Where: A_1 = Number of inches table or saddle is moved by rapid traverse.
B_1 = Number of times feed or traverse is engaged.
C_1 = Number of inches table or saddle is moved by hand.
D_1 = Number of clamps (already in place).
E_1 = Number of clamps (placed and removed complete).
F_1 = Number of locating pins in fixture.
G_1 = Number of screws tightened by hand.
H_1 = Number of screws tightened by wrench.
J_1 = Number of thumb nuts tightened by hand.
K_1 = Number of times table is raised or lowered, set and locked.
L_1 = Number of times profiler head is raised and lowered.
M_1 = Number of times profiler head is set and locked.
N_1 = Number of times cutter is set to set piece, when two or more operations are performed at the same time.

Note: The term "allowed time" used in these and following data represents the time required by any worker to perform a given unit of work, using average skill, showing average effort, under average conditions, with average consistency, allowing for fatigue, personal needs and unavoidable delays. *It is the time within which the worker is expected to perform that work.* All times are given in decimal hours. Accurate conversions to minutes and seconds can be made by means of the following formulas: Decimal hours X 60 = decimal minutes; decimal hours X 3600 = decimal seconds. The data given represents standards developed for use at East Pittsburgh Works of Westinghouse Electric & Manufacturing Company for conditions of work existing in that plant. Each allowance should be checked in the light of local conditions before being applied in any other plant.

Time-Data Sheet No. 18

Milling and Profiling Time Data—II

P_1 = Start cut (mill keyway only).
Q_1 = Start cut (profile keyway only).
R_1 = Open and close hinged cover.
S_1 = Number of times part is shimmed.
T_1 = Number of jacks set (time per jack).
V_1 = Number of times part is lined up and set with cutter, where set-up will not repeat.
MT = Milling or profiling time—see Tables No. 9, 10 and 11.
X = Number of parts machined at one time.
T = Number of times part is indexed or turned.

TABLE NO. 3—PART HANDLING CONSTANTS WHEN USING FIXTURE

0.0021 = Constant for very small part in fixture (0—0.50 lb.).
0.0032 = Constant for small part in fixture (0.51—5.0 lb.).
0.0063 = Constant for medium part in fixture (5.1—20.0 lb.).
0.0094 = Constant for large part in fixture (20.1—45.0 lb.).
0.0157 = Constant for very large part in fixture (45.1—75.0 lb.).
0.0802 = Constant for very large part in fixture (Over 75 lb.—handled by jib crane).

TABLE NO. 4—PART HANDLING CONSTANTS WHEN USING VISE

0.0014 = Constant for very small part in vise (0—0.50 lb.).
0.0024 = Constant for small part in vise (0.51—5.0 lb.).
0.0045 = Constant for medium part in vise (5.1—20.0 lb.).
0.0071 = Constant for large part in vise (20.1—45.0 lb.).
0.0085 = Constant for small part in vise—one end clamped to table.
0.0106 = Constant for medium part in vise—one end clamped to table.
0.0132 = Constant for large part in vise—one end clamped to table.

TABLE NO. 5—PART HANDLING CONSTANTS WHEN PART IS CLAMPED TO TABLE

0.0024 = Constant for small part on table (0.51—5.0 lb.).
0.0046 = Constant for medium part on table (5.1—20.0 lb.).
0.0071 = Constant for large part on table (20.1—45.0 lb.).
0.0118 = Constant for very large part on table (45.—75.0 lb.).
0.0640 = Constant for very large part on table (Over 75 lb.—handled by jib crane).

TABLE NO. 6—"LINE UP PART" CONSTANTS

0.0016 = Constant for line up part with scale.
0.0093 = Constant for line up small part with surface gage.
0.0155 = Constant for line up medium part with surface gage.
0.0320 = Constant for line up large part with surface gage.
0.0062 = Constant for line up small part with square.
0.0124 = Constant for line up medium part with square.
0.0299 = Constant for line up large part with square.
0.0113 = Constant for line up small part with level.
0.0206 = Constant for line up medium part with level.
0.0360 = Constant for line up large part with level.

TABLE NO. 7—SPECIAL OPERATIONS

0.0224 = Place additional support on milling machine and remove (per support).
0.0490 = Fasten locating block to angle plate.
0.0011 = Center part in vise, in fixture, or on table.
0.0020 = Move stock forward in vise.
0.0164 = Place C-clamp on bar stock.
0.0258 = Jib crane lift, when an additional lift is required to turn piece, etc.

TABLE NO. 8—GAGING OPERATIONS

0.0027 = Gage with micrometer.
0.0013 = Gage with snap gage.
0.0013 = Gage with calipers.
0.0017 = Gage with scale.

APPLICATION:

This formula applies to all work done on standard milling machines and profilers of the knee and column type in the East Pittsburgh Works, equipped with or without rapid traverse.

ANALYSIS:

Tools and Accessories:

The tools and accessories needed are 6 and 12 in. scales, level, square, protractor, micrometers, surface gage, rawhide and copper mallets, screw driver, assortment of open end wrenches, brush, oil can, arbors, cutters, vise, angle plates, liners, bolts, clamps and fixtures. Work is held on the machine table by clamps, vise or fixture. A fixture is made when it will reduce the handling time and the activity of the part warrants the investment. Fixtures also are used on less active jobs where necessary to insure accurate work.

Removing Burrs:

All burrs should be removed by the operator when the milling time is sufficient to allow him to do this without loss of production time. When the cutting time is not sufficient, the burrs should be removed at the bench in a separate operation.

Material Handling:

No time is allowed in the formula to handle material to the machines. This should be taken care of by a movemen, who may or may not be included in the machining group. This will depend on whether or not it is the policy to include expense labor with productive labor. In case his time is to be included in the group rate, an allowance should be made to take care of it. All parts weighing more than 75 lb. should be routed to machines served by jib cranes.

Group Leader:

The group leader gives out the work to the operators and should plan his work so that each operator has a job ahead of him. He should see that the operator has the proper information, drawings, material and tools before starting the job and should arrange the work so that the job will be given to the man or machine best fitted to perform the operation. The group leader can do much to increase the efficiency and earnings of the group by careful attention to his duties.

In any group the group leader ordinarily performs tasks formerly done by the individual operators and his time is taken care of by the standard allowances for these tasks. These allowances, such as: get drawing, tools, fixtures, time slips and make partial set-ups, occur in each set-up allowance. In small groups, where the duties assigned to the group leader do not constitute a day's work, the group leader should be assigned a machine and be expected to participate in actual production.

Inspection:

Time is allowed for the operator to take the first piece to the inspector and return. It is believed that it is better for the operator to continue with the job while the piece is being inspected, since it usually is true that losses due to spoiled work are less than the loss incurred as a result of the operator waiting for the inspector. A good operator shoud not rely on the inspector, but should be reasonably certain in his own mind that the job is correct.

(To be continued in an early issue.)

Shearing and Notching

These operations may be combined with others in multi-station tools or done in simple universal dies suitable for many different parts

C. W. HINMAN
Tool Engineer
Kozby Tool & Electric Mfg. Company

BURNISHING DIES are closely related to shaving dies because shaved edges are never perfectly smooth without burnishing. If a shaved edge is examined under a good lens it will be found to resemble the cross lines on the edge of a file. These parallel lines represent minute irregularities in the cutting edges of the shaving die.

Shaved edges are usually satisfactory for pieces in ordinary use, but for small working parts in precision mechanisms, a burnishing operation is necessary to obtain smooth polished edges. A burnishing die is illustrated in Fig. 61.

In a burnishing tool, the die opening is slightly tapered inward from the top surface and downward through the die block. The tapered surface ends $\frac{3}{16}$ in. from the bottom of the block, and for the remaining distance, the sides of the opening are vertical. The interior of the die is finished smoothly and after hardening it is then highly polished. When the blank is forced through the die, by the punch behind it, the edges of the piece are compressed, and in crowding through the slightly tapered opening the edges take the same degree of polish as provided in the die.

Burnishing Round Holes

The interior of round pierced holes can be burnished to size by forcing commercial steel balls through them with a punch. The balls drop into a tray under the die and roll out in front of the press and are used again. Punch diameters are made 0.005 in. less than the hole sizes, and stripping the work from punches is unnecessary. This operation may be satisfactory for small consignments, but is too slow for regular production. For burnishing holes rapidly, highly polished bullet-nosed punch points are used. The work is stripped off under an open-side, positively attached stripper plate, or by a spring pad surrounding the punches.

The stripping is sometimes done by a "knock-off plate" that surrounds the punches and is operated by an attached knock-out rod carried up through the punch shank. The work clings on the punches after they enter the work and is carried up when the ram ascends. Stripping occurs when the free end of the knock-out rod contacts the cross-bar through the head of the press. The method of stripping depends upon the conditions involved.

A type of shearing-off die is shown in Fig. 62. This tool stamps the

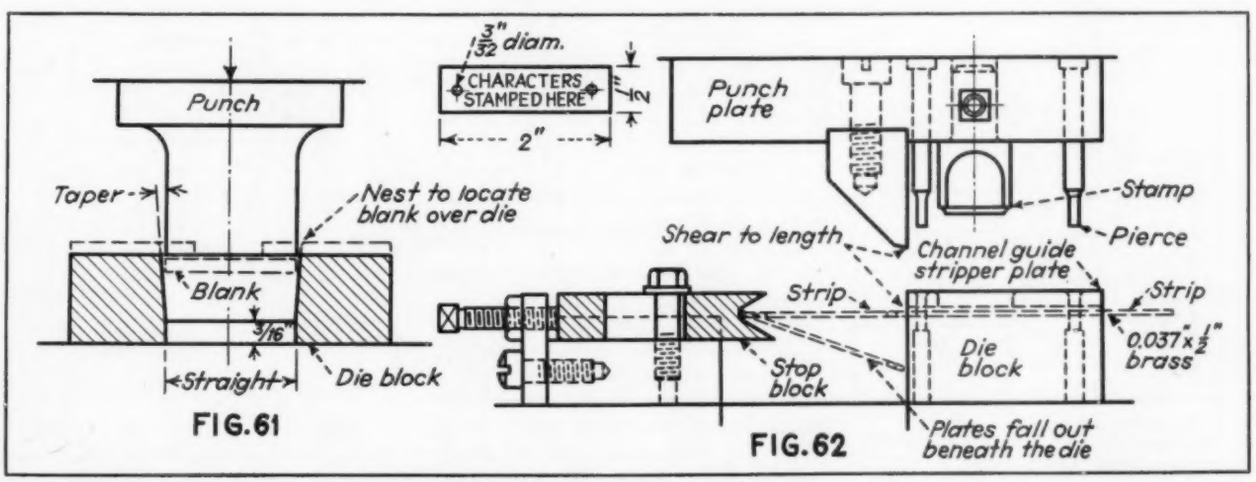


Fig. 61—Forcing a shaved part through a highly polished tapered die will burnish the edges for better operation in precision mechanism. Fig. 62—In this shearing-off die, stock is fed to the stop block for piercing and stamping at the first station and for shearing at the second station

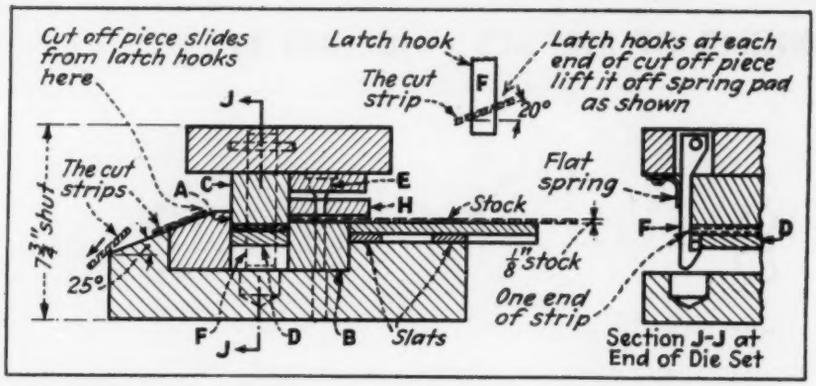


Fig. 63—Several difficulties in operating this die for shearing strips from wide sheet are overcome by the hook latches F that lift the cut strip and let it slide down the ramp at the left

lettering and pierces two mounting holes in a name plate, and then shears the plates to length in the second station. The sketch clearly shows the operation.

An improvement in this tool is to introduce a spring pad between the shearing edge on the die block and the stop block at the left. The shearing punch should be the same length as the pad. The sheared off pieces are blown off the pad by compressed air, or by inclining the press they slide off in the rear. The die set used is a standard type with two posts in the rear.

Shearing Strips

Fig. 63 illustrates a shearing off die for cutting strips from wide sheets of heavy material. This operation is not as simple as it first appears. The stock is ⅛ in. thick sheet steel 36 in. wide, and the cut strips are 2¼ in. wide by 36 in. long. The operation is performed in a large straight-side press, and the stock is therefore fed from the front to the rear of the press.

Positive stop *A* must be high enough above the surface of cutting block *B* to act as a back-up for the cutting-off punch *C* before it begins to cut. A spring pad *D* is necessary under the cut strip to hold it in a horizontal position during the cutting interval. The spring pad prevents the work from tipping on its cut off edge as an axis, which would result in cutting an angular edge not wanted.

However, this design has a serious fault; when the punch ascends, followed by the cut work on the spring pad, there remains no way in which to remove the strip automatically and the stock cannot be fed forward for the next cut. The previously cut strip interferes. The strip is too long and the die is positioned the wrong way in the press to facilitate pushing out the strips endwise.

Hooks Remove Strips

These difficulties are overcome by attaching two hinged latch hooks *F* at either ends of the stripper plate. These hooks have a 20-deg. slant in their hooking surfaces. Therefore, when the hooks ascend with the ram, they lift the sheared off strip from the pad, and continuing upward, lift the work above the top of the back stop, allowing it to tip to the 20-deg. angle and to slide off the inclined delivery table as shown.

If desired, a perforating operation can be made at the right of the cut in the oncoming strip as indicated by the punch *E* and stripper plate *H* in the sketch. The face of the cutting punch is ground to a shearing angle of a height about the thickness of the material used. The shearing angle starts at the center of the punch and extends each way across the sheet to be cut. This slight shear does not distort the strip. A frame of angle iron and cross slats 34 in. long and the proper width is constructed on the right-hand side of the die shoe for guiding the sheet up to the tool.

Removing Pieces with Vacuum

When stamping or cutting off small pieces of work, and even quite heavy pieces, they can be removed from a die face after the operation by using a soft-rubber vacuum tip mounted on the end of a spring punch. In the down stroke the rubber tip engages on the piece by suc-

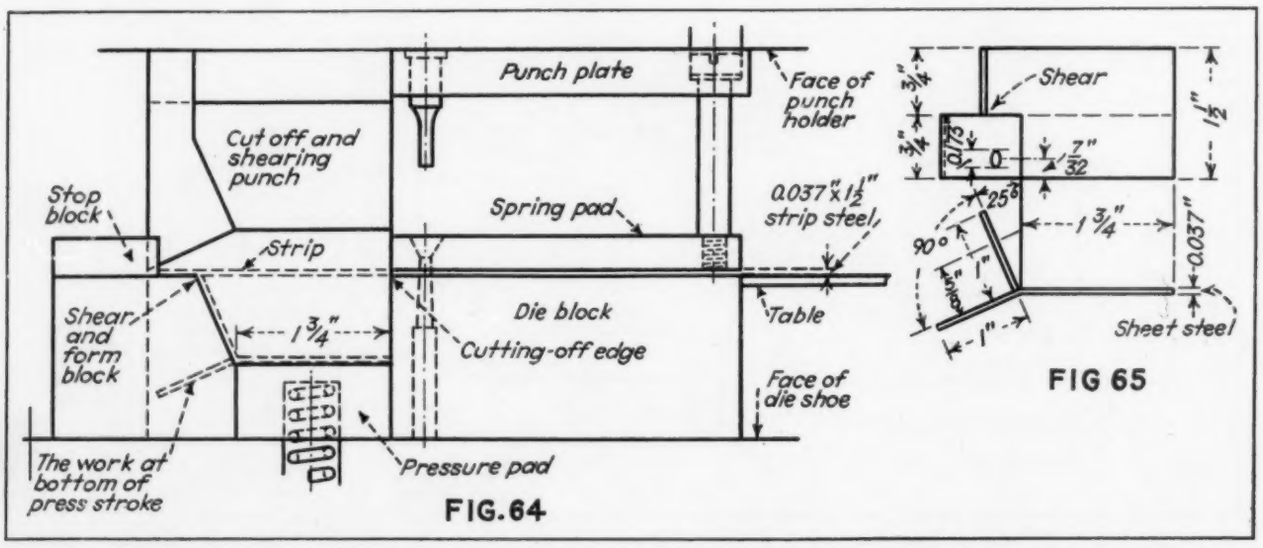


Fig. 64—The radio grid shield, Fig. 65, is pierced at the first station, and then sheared or split partially from one edge, cut off at the other edge, and wings formed in opposite directions in this two-station tool

tion and the reverse stroke carries up the work for removal by an overhanging finger. The piece then falls behind the press.

Shearing and Cutting-Off Die

Fig. 64 shows a piercing, shearing, forming and cutting-off die in which the principle of shearing predominates. The work is shown in Fig. 65, and is called a "grid shield" by radio manufacturers. After piercing one hole in the first station, the strip is advanced over the $1\frac{3}{4}$" in. length left, and securing it rigidly with heavy clamp screws. In this design, the tool can be quickly set up for shearing different widths of rectangular strips. The lengths of the strips is determined by the width of the die, and by the width of the material sheet used. The sketch and accompanying notes show the idea plainly. If the die block is provided with die bushings, and corresponding piercing punches, holes can be pierced in the first station for the blanks. The punches are backed up with screws,

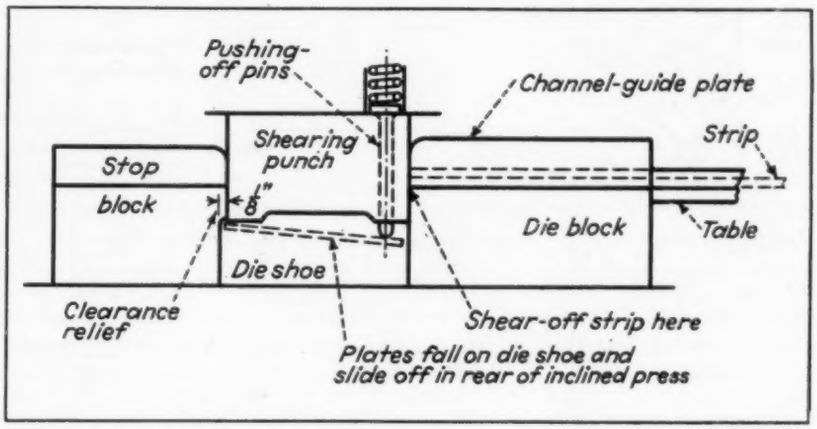


Fig. 66—Universal shearing dies are fitted with an adjustable stop block for cutting rectangular blanks of various widths

of pressure pad, which is normally flush with the die, until the end of the strip contacts the stop block shown at the left.

When the ram descends again, the forward point on the cutting-off and shearing punch starts shearing the strip lengthwise against the shearing block. The cut is kept straight by the pressure of the pad under the strip. The pad pressure begins when the punch, continuing in descent, cuts off the strip on the left edge of the die block. A further descent of the shearing punch completes the depth of the cut on the shearing block, and simultaneously forms one sheared wing *up* and the other one *down*. The formed wings are "spanked" straight when forced by the punch faces against the angular face on the shearing block. This occurs at the moment when the pressure pad "banks" on the die shoe at the bottom of the press stroke.

Shearing Rectangular Blocks

Most well-equipped press rooms have a universal shearing die. The principle of the tool is seen in Fig. 66. Such dies can be made adjustable by arranging the stop to slide within a retaining slot, toward the right or and any one or more of the punches can be raised to omit certain holes.

Portable Perforating Punches

Commercial drop-forged steel screw punches are available in several sizes for punching round holes from $\frac{1}{8}$ up to 1 in. in diameter. An illustration of the design is represented by Fig. 67. One of the larger screw punches weighs 180 lb., and dimension *A* is $6\frac{1}{2}$ in. and *B* is $4\frac{1}{2}$ in. These tools are operated by using a steel bar through the holes in the screw head, or by applying a wrench on the square head. Perforations 1 in. diameter are pierced without difficulty through boiler plates $\frac{5}{8}$ in. thick. There are smaller screw punches that weigh only 5 lb. for piercing a maximum sized hole of $\frac{3}{8}$ in. diameter through $\frac{1}{8}$-in. sheet steel.

A large variety of sizes in punches and dies can be cheaply purchased for these tools. A center point projection is provided on the punch faces. The point on the punch is first located in a center punch mark made in the sheet where the hole is wanted, and then the punch is forced through the material by the screw.

These tools are convenient for perforating holes through plates that are attached on a machine, or for plates too cumbersome to drill, or to be carried to a punch press for the operation. With this tool, the punch and die can be taken to the job.

Adjustable Piercing Die

A press tool that saves much time, and is very inexpensive to make, is a universal piercing punch and die, similar in principle to the one shown in Fig. 68. This tool is useful when building apparatus from standard structural steel sections.

Stripper yoke *A* is made from $\frac{1}{2}$ in. strip steel. The elongated slots are for capscrews that secure the yoke on the press head. These slots also provide for vertical adjustment of the stripper face for different thicknesses of work sheets. The punch holder carries the sliding quill *B*, the lower end of which is tapped to receive the commercial coupling nut and punches shown in Fig. 67. The die block is provided with commercial dies.

For piercing any number or diameters of holes in duplicate sheet-metal parts, and in any quantities, a center punching templet is made with $\frac{3}{16}$-in. holes located to suit the parts to be pierced. The templet, of $\frac{1}{8}$ in. sheet steel, is fastened over the work piece similarly to a plate drilling jig. A $\frac{3}{16}$ in. center punch is used through the holes in the templet to mark the hole centers. The work is then placed on the die, and the sliding quill is raised to admit placing the point of the punch into the centering mark. The press is then operated and the hole is pierced.

The method of reducing the vertical descent of a punch to a distance *less* than the press stroke *S*, is also shown in Fig. 68. The punch in the sketch really descends only a distance of S-C. If the press stroke is $1\frac{1}{2}$ in., and *C* is $\frac{1}{2}$ in., the punch descends only 1 in.

All the standard sizes of punches and dies can be purchased for this tool at a fraction of the cost for making them. This die has no guide posts. These would interfere with the work when punching holes far within large sheets. Without guide posts, the rear limit of the work sheet size is the throat depth of the press.

One of many designs for universal notching dies is illustrated in Fig. 69. The sketch is a plan view. The

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* The method of reducing the vertical descent of a punch to a distance *less* than the press stroke *S*, is also shown in Fig. 68. The punch in the sketch really descends only a distance of S-C. If the press stroke is $1\frac{1}{2}$ in., and *C* is $\frac{1}{2}$ in., the punch descends only 1 in.

scheme is to shape the die opening so that by using a properly fitted punch, various contours can be cut into the edges of previously prepared blanks. The shaded portion of the sketch, shown in the die opening, represents the heel on the punch, which prevents punch deflection and consequent damage to the cutting edges.

The prepared blanks may have been cut in a first-operation blanking die, or possibly are of rectangular shape, sheared off as shown in Fig. 66. The die block is made unusually large. The idea is to provide space for many tapped holes and dowel pin holes, used for attaching a varied number of special gaging blocks for locating the sides or ends of any peculiarly shaped blanks that the die might be used for. This is an excellent tool for the small shop. It often saves the time and expense which might be otherwise uselessly expended in the design and construction of special blanking dies.

The sketch shows a square corner cut in the side of a rectangular blank while it is located between gages *A—A*. Having two or more of these tools with varied shapes in the die openings, the outlines of an endless variety of blanks can be cut. For instance, the blank for a steel box, Fig. 70, is made in a similar tool. Folding of the blank into a box is done in a universal forming die which is described under that heading. Ingenuity is required in designing and arranging special gage blocks, to get certain blank contours from these tools. The tool is used mostly for small orders. Commercial machines have been highly developed for doing similar work on a large scale. These are called turret punching machines.

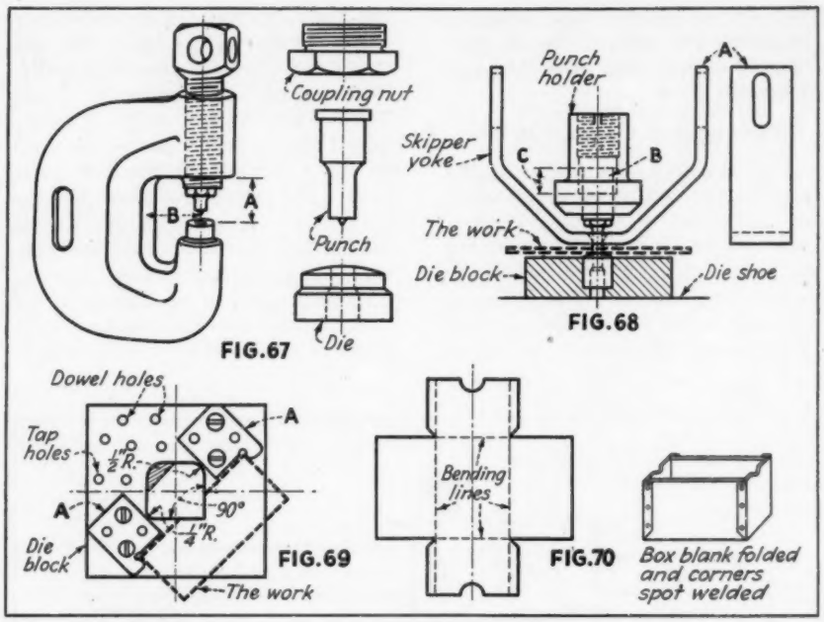


Fig. 67—Commercial screw punches are built to perforate holes up to 1 in. in ⅝-in. boiler plate, and can be fitted with various sizes of punches and dies. Fig. 68—A formed stripper yoke fastened to the head of a deep-throat press and sliding quill B attached to the punch holder can be used with a commercial coupling nut and punches for piercing holes anywhere in a wide sheet. Fig. 69—An extra large die block having many tapped holes and dowel pin holes can be used for locating gages where desired to notch a particular blank. Fig. 70—A blank for a steel box was first notched with a universal notching die and then folded up in a universal forming die

Part 13 of Mr. Hinman's series will appear in an early number.

Product Design vs. Tool Design

KNOX A. POWELL

As a cub draftsman, I was once dismayed to find my design controlled much more by the mere exigencies of rectangular coordinates than by actual part necessity. Moreover, like many young engineers I hated to back track, and would try to figure myself out of a tight place with absurdly close clearness and even with special bolts to be manipulated with peculiar wrenches. However, when by dint of much coaching I had finally produced a workable design, imagine my chagrin to find shop engineering adhering meticulously to the letter of the incidental specifications, but calmly planning liberties with concentricity, type of finish and flatness of surface that would be ruinous.

Later as tool engineer, I once found an important piece all nicely dimensioned with close tolerances from a center line. Undoubtedly the center line was a very real locating point on the drafting board, but it was purely imaginary on the actual part. The harried draftsman explained that he had never been able to dimension to accord with the locating points subsequently selected with impish ingenuity by the tool designer, and expressed a wistful hope that at least some of the design idea might survive to the finished product.

A designer may well come to feel that if there is any possible loophole in the drawing specification by which the shop can stick to the letter and yet lose the real point, the tool designer will use it. The design engineer may come to suppose that, like polishing brass buttons in the army, scrupulous insistance on unimportant detail will tend to prevent missing really important points when they do come up. Personally, I have yet to meet a designer who would not let the tool engineer rephrase specifications in almost any terms if he would only promise to nurse the design idea along to the finished product.

All of which voices my sympathy and resentment to the article on this subject by A. E. Rylander (*AM*—Vol. 82, page 957). The product designer and the tool designer are not antagonists (or shouldn't be). A little insight into the other fellow's job would avoid a lot of trouble.

Eyes Forward

NOW THAT the after effects of New Year's Eve have worn off, let's consider for a few moments where we stand as we go into 1939. It isn't a bad idea once in a while to orient our thoughts and decide where we are headed and what are the obstacles in the way. The beginning of a New Year is a good time to indulge in such a preview.

Despite all the alarmist talk the last few years about the disintegration of democracy and of our capitalist system, somehow or other both democracy and private enterprise are still doing business at the same old stand in the United States. And we have a hunch that they aren't so close to folding up as the pressure groups and the "pink" boys would have us believe.

From a recent visit to Washington we gathered the impression that crusading zeal in government circles has been tempered by a commendable and sincere desire to make our system work. A *rapprochement* between government and business seems nearer than at any time since the New Deal took over. Not that government regulation of business is about to be lifted. It is here to stay, but it will be modified by an understanding of industry and its problems. Part of this changed attitude is traceable to the conservative trends of recent elections.

Remember the days when pigs were slaughtered and thousands of acres of cotton ploughed under? The idea of controlled production based on scarcity has been tossed aside by most of the New Deal fraternity, who now are singing a different song. The theme is the greatest possible production and consumption of goods, and the main problem is to remove all barriers which restrict plentiful output. That is a change in emphasis which industry unitedly will applaud.

Don't misunderstand us. New Year's cheer hasn't gone to our head and beclouded the fact that we are still facing tasks the solution of which sometimes seems beyond the scope of our abilities. But somehow even these tasks don't loom so ominously from the window of a quiet house in the country as they do from the twenty-ninth floor looking down on the noise and congestion of mid-Manhattan. Possibly too much of the time we are too close to our problems to view them in the proper perspective.

Nationally our biggest job is to find a way to put millions back to work. It is a paradox, and a serious reflection on our intelligence, that in many parts of the country jobs should go begging when there doesn't appear to be enough work to go round. That is because these jobs are specialized and require trained men. Such training should be directed toward meeting known shortages and anticipated shortages in certain fields, and toward educating men technologically displaced so that they can fill new jobs.

Industry must plan its work better if it wishes to keep government regulation at a minimum. What people want more than anything else is a reasonable measure of economic security. It is squarely up to industry to do some pioneering to see if such security is attainable. To say that it can't be done is confessing paucity of ideas and lack of leadership. Hormel, Nunn-Bush and others are trying out guaranteed annual wages; General Motors has started an income security plan and a layoff benefit plan. Many other companies are experimenting with programs for stabilizing production and employment. All employers individually and collectively should tackle this problem for their own good and for that of their employees.

Then there is the matter of preserving democracy and our system of government. There are precious few places left in the world where we can say what we think, print what we think and live as we choose, free from the prying and sinister influence of dictatorial governments. If we are wise, we shall hold onto what we have and not let a whit of it slide through our fingers. This is the chief reason why we think adequate national defense is so important and why we are devoting a series of editorial sections, beginning in this issue, to it.

Burnham Finney

GAGING BUSINESS

All branches of metal-working industry look for upswing in business during first quarter. Machinery inquiries from domestic users and from abroad are increasing.

As the new year opens, all branches of the metal-working industry are in a much better position than they were a year ago and are confident of a rising volume of business. Machine tool orders have been of moderate size. Inquiries both from domestic users and from abroad indicate increasing sales as the first quarter progresses. Steel operations have rebounded from the holiday low and promise to expand further this month. Automotive production is seasonally off, with the spring upswing expected in March. Output in January and February, however, will be far above the level of the corresponding months of 1938. Government buying for national defense purposes has started an expansion of boom proportions in shipbuilding and shortly is expected to aid the aircraft industry, which already has impressive backlogs of orders. Army and navy purchases are providing stimulus to almost all branches of metal-working. A flurry of orders for railroad equipment is reported. Heavy engineering awards are better than those a year ago. Business Week's Index of Business activity stands at 103.5 compared with 105.1 a month ago.

NEW ENGLAND — Government orders continue to give a lift to equipment purchases. Newport Naval Torpedo Station is buying a number of machines, and the Springfield armory is in the market. Good equipment business is in prospect from shipyards. Textile machinery is reported in better demand. Automobile parts companies are doing well.

NEW YORK — Machinery makers report a sizable number of inquiries. Government awards have benefitted companies in this district. Navy and private shipyards are swinging into big building programs.

PITTSBURGH—Railroad equipment orders and good structural steel lettings have bolstered the steel rate which is around 53 per cent of capacity. Despite heavy buying in October, demand for flat-rolled steel is good, with considerable automotive tonnage expected this month. Machinery sales are sluggish. Westinghouse is looking for a big year in electric refrigerators and ranges. It has been awarded a large contract for the navy.

CLEVELAND — The steel rate is swinging back up after a holiday pause, but auto parts factory schedules temporarily are down. Machinery builders do not expect improvement in January, but pin their hopes on increased bookings during the coming month.

DETROIT—Tool and die shops are at a seasonal low point, with virtually no work at hand except on Reo truck body dies. Even there the initial order for $100,000 of dies has been suspended pending reorganization under trustee A. J. Brandt. An upturn in the small tool and supply trade is looked for after the middle of January. Machinery purchases at Toledo are likely to be about the same as in December, which was a dull month.

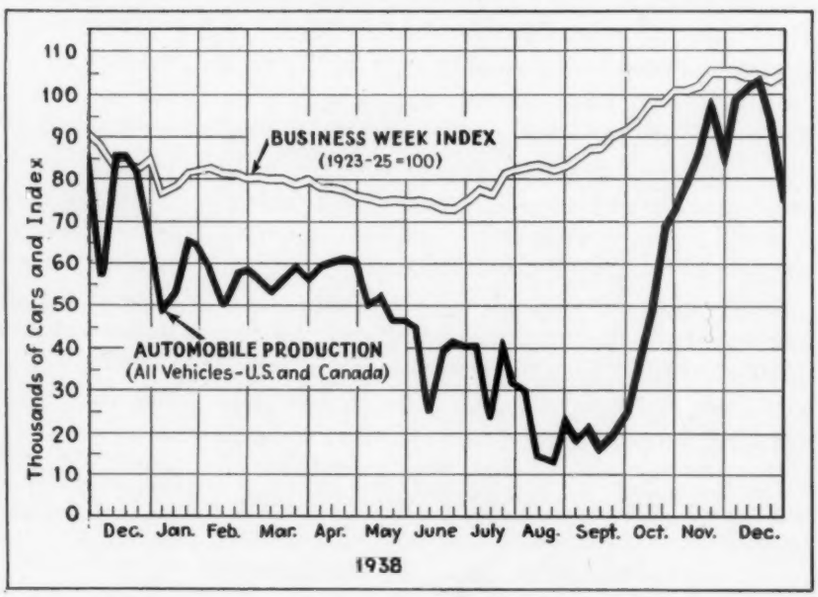
CINCINNATI — Domestic machine tool orders have been poor. Increased inquiries from abroad, however, give hope of a pick-up in bookings during January. Scattered government purchases of machinery are reported. At Dayton National Cash Register expects to maintain employment for 6,900 workers on a 35-hr. week during the winter. Machinery orders and inquiries at Indianapolis have broadened, and conditions are believed to be better than at any time in 1938.

CHICAGO — Tempered optimism exists in this district. Small motor manufacturers report a good volume of orders, while contract shops are doing fairly well. Steel mill operations are mounting. Steel buying for tractor and truck production has been brisk, and railroad purchases for spring track renewal have increased. Miscellaneous steel orders have dropped off seasonally. Cuts in farm implement prices have not helped yet to stimulate sales. International Harvester is reported planning manufacture of a new small tractor.

SAN FRANCISCO — The award of two freighters at cost of $6,000,000 to Moore Dry Dock at Oakland is the big event in western shipping circles. Machinery orders in general are better. Electric utility companies plan to spend more for equipment in 1939 than in 1938. Northwest lumber mills report a slight decline in orders. Airplane builders have $70,000,000 of orders on their books.

AUTOMOBILE PRODUCTION VS. GENERAL BUSINESS

A duller used car market indicates that production, which was curtailed by the recent holidays, will continue slack through the month of January.



NEWS OF THE INDUSTRY

New Plan Gives Promise of CIO-AFL Peace: Auto Makers Consider Labor's New Proposal

UAW Offers to Guarantee Contract Observance in Return for Preferential Shop

FRANK RISING
Labor Editor, American Machinist

NEW YORK—The C.I.O. and A.F.L. have a new plan for arriving at a settlement of their difficulties. At least some of the leaders on both sides are trying out this scheme: single A.F.L. unions are to make peace with the C.I.O. by defining more clearly their jurisdictional field. After this is done, a blanket agreement would be reached regarding workers in fields which overlap into the industrial union provinces of C.I.O., such as electrical manufacture. Conferences already have been held in friendly fashion between organizers on both sides in the electrical manufacturing industry.

DISCIPLINE FOR AUTO LOCALS

Aside from this renewal of peace efforts, biggest labor news comes from the automotive front. Within the past few weeks the U.A.W. has made the following proposition to several car makers: "give us freedom from worry about union-cracking moves by signing for a preferential shop and we'll guarantee contract observance, with severe discipline for members or locals breaking the rules." This offer is now under consideration, with the main point of dispute being definition of preferential shop so as to keep it from being turned into a closed shop.

NO STRONG DEMANDS EXPECTED

Unions are not expected to make any strong demands for higher wages or shorter hours during the next three or four months. Chances are in favor of renewal of steel company contracts with the S.W.O.C. many of which now contain 20-day breakaway clauses by which either side can cancel. S.W.O.C. hasn't the money or the wish to "get tough" with the two big non-union companies—Bethlehem and Republic. If prosperity should set in in a big way, things might be different. Meanwhile the union will take it out in words and not start swinging.

CAR MAKERS IN MARKET

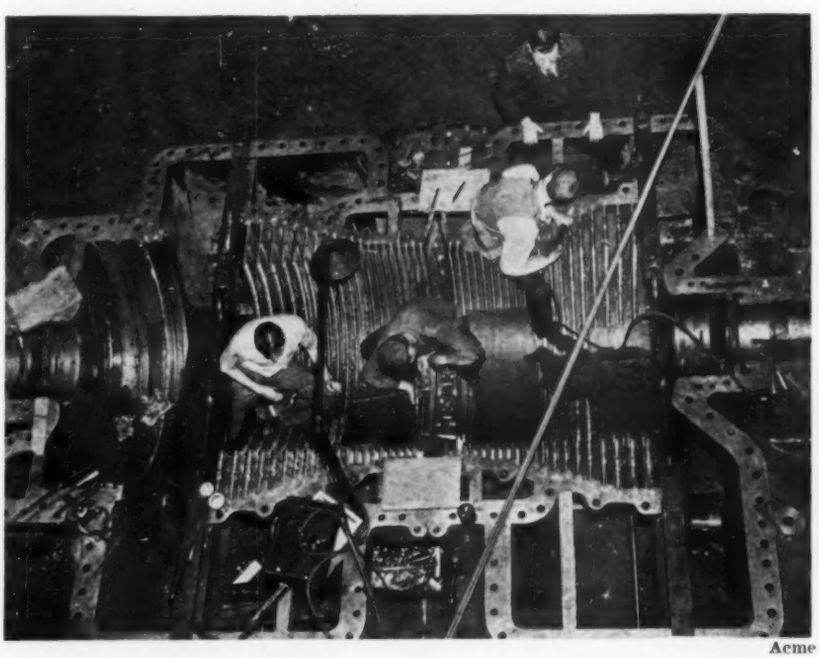
DETROIT—Machine tool builders see much better business ahead from car manufacturers. The bulk of the programs suddenly being released for quotations are for economy purposes—to simplify production methods and to clean up details of transmissions and remote control gear shifts. At least two companies are actively in the market and others are expected soon. Most of Packard's good-sized appropriation for the new light six will go for sheet metal changes and for lightening the front suspension.

SHIPBUILDING ACTIVITY AT RECORD LEVEL; LIMITED BY SKILLED LABOR SHORTAGE

NEW YORK—The shipbuilding industry is booming along at an all-time high and promises to expand its operations even farther in the next year, according to a survey made by *American Machinist*.

Employment is increasing and would be accelerated beyond its present pace if more skilled men were available. Eager to push along its program as rapidly as possible, the Navy itself would go to multiple shifts if it could recruit enough trained workers. It is estimated that by virtue of the Navy Department program of "in service" training to provide skilled employees in the shipbuilding trades and occupations the number of civil employees of the Navy Department and its field activities will increase from the present level of 72,000 to a peak of 100,000 persons by the end of the fiscal year 1942.

For the third consecutive year, the



Acme

A Delicate Job—*A high degree of skill is required in many shipbuilding trades, as the task of blading the turbine casing above would indicate. The turbine will be part of the main driving machinery of the* America, *the largest liner ever built in this country, which is scheduled for launching in July*

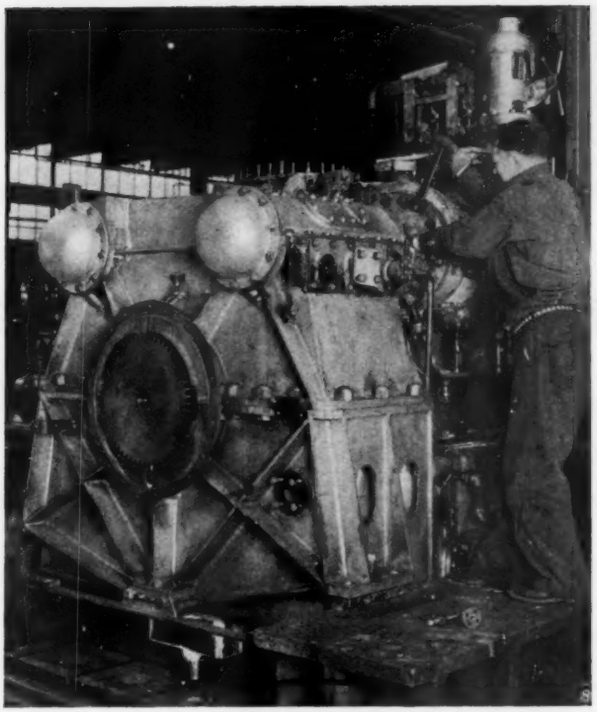
shipyards have set a new record in the volume of work under construction. At present there are 994,219 tons of new ships being built, of which 604,619 tons are merchant ships and 389,600 tons are naval vessels. The recent expansion in shipbuilding marks the beginning of the large-scale rehabilitation for the American merchant marine under the direction of the United States Maritime Commission—a ten-year program of 500 vessels to cost of $1,250,000 and to provide an orderly and systematic replacement of a considerable amount of obsolete tonnage.

SEE DOUBLED NUMBER OF WORKERS

It is estimated from the Martime Commission program that the ships already ordered and those to be ordered during 1939 will involve an expenditure of approximately $140,000,000 for shipyard labor, and about $175,000,000 for the purchase of material; however, a part of the latter will sift down into wages. In addition, there will be about $78,000,000 assignable to overhead and profit. In conjunction with its program, the Commission estimates a 110 per cent increase in the total number of shipyard workers by the end of the 1940 fiscal year.

BUSINESS FOR SOUTH, WEST COAST

For the first time in years contracts are being let on the West Coast and in the South, this being done to foster the development of shipbuilding facilities necessary in the Government's scheme for national defense. In the South and New England, progress is being made to reopen shipyards which were active during the war period, while at least two major shipyards at planning extensive expansion to permit construction of merchant vessels while carrying on major naval contracts. With the larger yards occupied for many months with merchant and naval orders which are now on hand, it is likely that an appreciable number of rehabilitated shipyards will enter into the expanding program during the coming year.



Almost hidden behind its reduction gear housing is the main drive turbine of the new steam-electric locomotive recently completed by General Electric for the Union-Pacific Railway. Using steam at a pressure of 1,500 lb. results in an extremely compact unit

U. S. Government Contracts Awarded to Metal-Working Firms

(Awarded from Dec. 12–24 inclusive)

Contractor	Gov't Agency	Commodity	Amount
Bridgeport Thermostat Co., Bridgeport, Conn.	War, Ordnance	Practice bombs	114,800
Crucible Steel Co. of America, New York, N. Y.	Navy, S. & A.	Steel forgings	141,167
National Tube Co., Pittsburgh, Pa.	Navy, S. & A.	Steel forgings	160,000
Bethlehem Steel Co., Bethlehem, Pa.	Navy, S. & A.	Steel forgings	227,550
Midvale Co., Washington, D. C.	Navy, S. & A.	Steel forgings	29,646
Wm. R. Boots, Evansville, Ind.	Navy, S. & A.	Practice bombs	24,152
A. Finkl & Sons Co., Chicago, Ill.	War, Ordnance	Forgings	23,172
Truscon Steel Co., Newark, N. J.	WPA, Treas., Proc.	Doors	22,074
Crucible Steel Co. of America, N.Y.C.	Navy, S. & A.	Steel, tool	21,282
Bart Laboratories, Belleville, N. J.	War, Engineers	Mirrors, metallic	101,400
Revere Copper & Brass Inc., Baltimore, Md.	Navy, S. & A.	Brass pipe	25,012
Schramm, Inc., West Chester, Pa.	Farm Security Administration	Air compressors	23,392
Enterprise Engine Co. Div., Enterprise Foundry Corp., San Francisco, Cal.	Navy, S. & A.	Propelling plants	463,582
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy, S. & A.	Lathes	13,188
Rockford Machine Tool Co., Rockford, Ill.	Navy, S. & A.	Planings, slotting machines	48,030
Reed-Prentice Corp., Worcester, Mass.	Navy, S. & A.	Lathes	25,272
Brown & Sharpe Mfg. Co., Providence, R. I.	Navy, S. & A.	Milling machines	18,374
Henry Prentiss & Co., Inc., New York, N. Y.	Navy, S. & A.	Boring, drilling and milling machines	22,874
Bullard Co., Bridgeport, Conn.	Navy, S. & A.	Lathes	17,535
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.	Navy, S. & A.	Jig boring machine	20,934
Caterpillar Tractor Co., Peoria, Ill.	Interior	Tractors	20,342
Morton Mfg. Co., Muskegon Heights, Mich.	Navy, S. & A.	Boring, drilling machines	28,750
Mattison Machine Works, Rockford, Ill.	Navy, S. & A.	Grinder	14,520
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy, S. & A.	Mill, boring	16,465
Universal Boring Machine Co., Hudson, Mass.	Navy, S. & A.	Boring and milling machine	74,766
Seneca Falls Machine Co., Seneca Falls, N. Y.	War, Ordnance	Lathe	68,500
Curtiss-Wright Corp., Curtiss Propeller Div., Clifton, N. J.	War, Air Corps	Hub assemblies	28,425

BUDGET ESTIMATES UP; DEFENSE UNITS FAVORED

WASHINGTON—Budget Bureau estimates for fiscal 1940 represent substantial increases over allowances for 1939. Typical is the recommendation of $721,000,000 for the Navy as against the previous year's $559,000,000.

The Bureau asks $22,000,000 for construction and repair, $27,000,000 for ordnance, $230,000,000 for supplies and accounts, $74,000,000 for the Bureau if Aeronautics (including $38,000,000 for construction of aircraft), and $270,000,000 for replacement of naval vessels.

At the same time President Roosevelt recommended to Congress that it appropriate $36,000,000 in first deficiency bill for replacements of vessels and for armor, armament and ammunition.

The estimate for the War Department is $505,000,000, only slightly more than the $496,000,000 for 1939. The President says that this department has considerable accumulated funds, and it is expected that he will supplement this estimate later on, possibly in a subsequent defense message.

One of the outstanding increases in the budget estimate is the $46,000,000 recommendation for the Ordnance Department, as compared with the $39,000,000 which was allocated for fiscal 1939.

Estimate for the Maritime Commission in 1940 is $100,000,000, plus contract authorization of $230,000,000 for constructiin and operating subsidies. The Commission had a $115,000,000 authorization fund in the 1937 third deficiency.

INSIDE DETROIT

By Rupert Le Grand

DETROIT EDITOR

Curtailment of January production schedules caused by seasonal factors results in some companies adopting temporary four-day week.

DETROIT—As already forecast, automobile production schedules for January have been trimmed by several important makers by 10–20 per cent. An outstanding exception is Ford, which has announced a goal of 85,000 units for the month. February schedules will also be lighter, with the Spring upturn coming the middle of March.

Current reductions are not unusual, because the industry never goes through the winter months without a decline in sales. And right now used cars are piling up, and a used-car jam is always the throttle on production. The situation has not yet become serious, but late model trade-ins are hard to dispose of, in contrast to the $100–300 class of cars.

FOUR-DAY WEEK

With the first new model buying rush over, slackened winter sales in effect, dealer stocks piling up (but not as high as last year), and used cars becoming more of a problem, it seems sensible for automotive companies to trim output. And some of them were glad to establish a four-day week on a temporary basis if for no other reason than to forestall a union demand for a 32-hr. week and for rehiring of additional thousands. It must be said, however, that Homer Martin of the U.A.W. disclaimed any desire for a 32-hr. week as a desirable permanent work week.

Where a 32-hr. week has prevailed, it is only a temporary expedient to adjust output to sales. If field reports improve, the five-day week will come back immediately. As a matter of fact, schedules in several plants are being stepped up or down on a week-to-week basis. Most recent four-day weeks have been purely for observance of legal holidays, and not because two of the large corporations have bowed to any union demand.

EQUIPMENT INQUIRIES UP

Equipment vendors are receiving more inquiries, but orders are hard to obtain. No real programs have cropped up, and even replacements or meritorious labor-saving suggestions are getting little attention. If Packard should put a light six on the market, it is understood that little equipment will be needed. The present six engine could easily be made in a smaller bore to give lower horsepower output. And with additional tooling, most of the present equipment could be made to serve for the light job.

U.A.W. TO TACKLE PARTS INDUSTRY

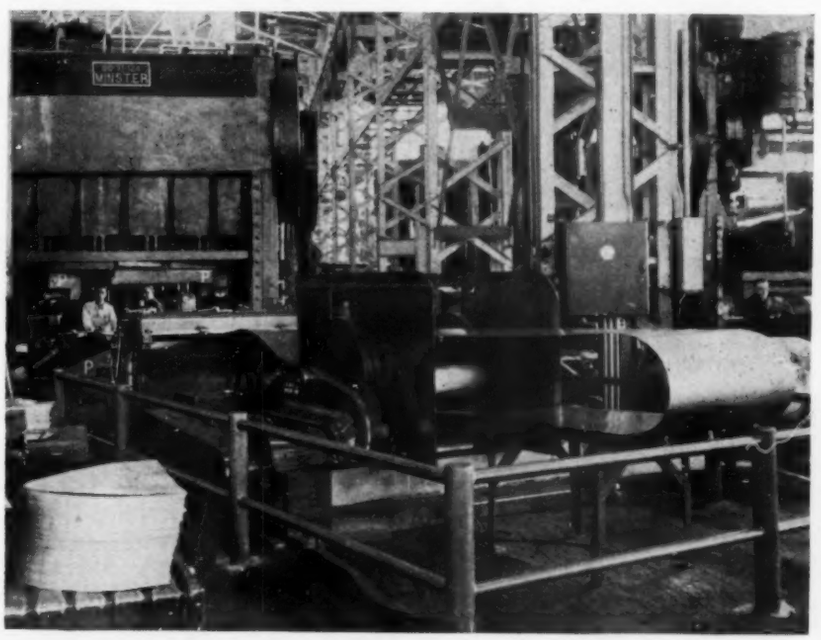
Key manufacturers in the automobile parts industry will soon be approached by the United Automobile Workers in regard to a new model contract designed to put a floor under wages. No attempt will be made to secure an exact equalization of rates. If leaders in several fields are responsive, and will exercise their influence with their manufacturers' associations to get back of the plan, the U.A.W. will call a national conference of all parts suppliers.

The idea is then to negotiate a blanket contract with the parts industry after the pattern followed in England by several industries and in the United States by the coal operators and the garment makers. Terms of the contract are to be broad, to be applicable to any plant.

Some 2,000 job classifications have already been set up by the U.A.W. and various categories of skill are allowed. For example, there may be three grades of diemakers or hammer men, and minimum wages will be established for each. The workers in a given plant would have their wages set according to the master chart. Since the rates are minimums only, plants wishing to do so because of policy reasons or local conditions would be free to pay more than the rates established. And these rates would most likely have a certain amount of flexibility to take care of plants remote from their markets.

PLAN WELL THOUGHT OUT

A definite attempt is being made by the U.A.W. to present a carefully thought out plan that will appeal to both management and men. From the managements' standpoint, the idea of more uniform wage rates is attractive in view of the widespread differences now existing in wage scales between city and small town shops. Should the plan be approved by large manufacturers associations, whose members comprise the bulk of the industry, the job of bringing the "fly-by-night" shops into line will be simplified. Moreover, with labor quiet, more time can be devoted to the essential business of running the plants and developing more efficient methods and better products. Since certain jobs have different rates because of differences in skill, the manufacturer will not feel that he is



For Better Feeding—*Two new automatic strip feeders have been placed in front of press lines at the De Soto stamping plant. Sheet metal up to 72 in. wide is uncoiled from a power driven reel through a hydraulic leveling unit, which in turn feeds the proper length to the press*

being bilked by paying too much for a certain grade of labor. And he will still be able to offer better wages to men who increase their skill.

A great deal of opposition is sure to arise through fears that this plan will strengthen the union. In reply, the argument will be raised that experience with the English system and with the garment makers pact has proved satisfactory. Furthermore, powerful support is being enlisted among automobile manufacturers. Edsel Ford has already declared in favor of buying from plants that pay fair wages, and has put that policy into effect, according to informed quarters. Negotiations with the other two members of the Big Three, as well as with the independents, are understood to be under way quietly to secure their support. This much may be said—the plan is being worked out in a deft manner, and for that reason appears to have some chance of success.

STILL MORE MECHANIZATION

Higher labor costs, more intricate products, and a compelling need to conserve floor space are reasons for the trend toward more automatic operations in assembly and press shop departments of automobile companies. Perhaps more time is available to production engineering departments because of the lack of major retooling programs. Anyway, some of the ideas now being put into effect are so simple of execution that one wonders why they were not put into operation before.

These home-made assembly machines may be built first in the automobile plant or in an outside specialty shop. But when second or third units are ordered, it is frequently the case that the principle of the device is incorporated into tooling or attachments to a standard machine tool, press or other machine, because of the inherently better design obtained by a combination of standard, well-designed units. So it may be expected that the present activities of many production engineers who are attacking obviously weak points where excessive labor is employed will in the long run benefit regular suppliers.

PRACTICAL DIFFICULTIES ENCOUNTERED

To adapt a fender press line to automatic operation appears attractive when one sees the number of men required to place the sheared blank into the dies, swab it with drawing compound, and "jackass" the stamping out of the dies. A lot of time is lost while the press is not actually operating. But there are many practical difficulties that must be licked.

Most of these large parts require some hand forming, such as pulling down one end at a 45 deg. angle, so that the part will enter the dies and draw correctly. This hand forming is an individual matter for each job, and is only worked out during the initial run on the press. Getting the fender out of the dies is a tough, awkward job. Transferring it to the next operation without scratching or denting is still another problem. Applying a thick drawing compound just where needed is not simple. Despite these difficulties, work is actively going forward to adapt feeding attachments and conveying methods to large presses for producing body stampings automatically.

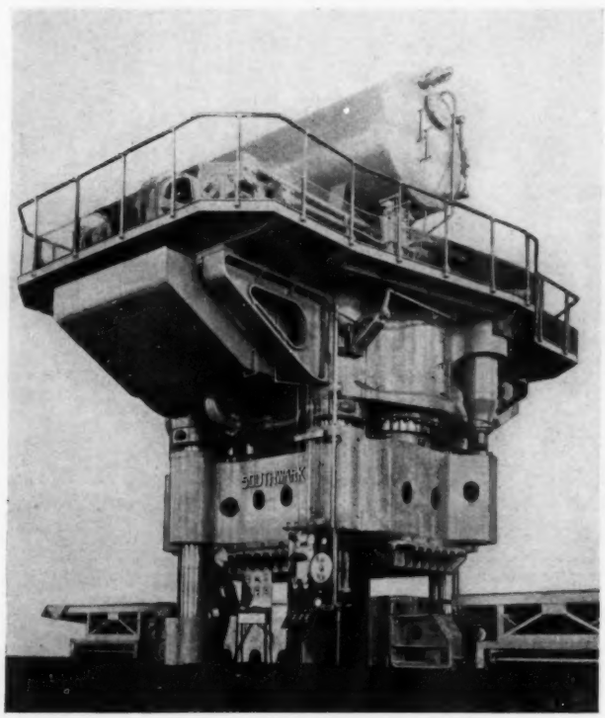
RFC INDUSTRIAL LOANS DOWN; PRIVATE BANK LENDING BELIEVED CAUSE

WASHINGTON—Loans to industry and purchase of industrial participations by the Reconstruction Finance Corporation have been falling off during the last three or four months. The R.F.C. is not sure whether this is due to the approach of winter with less demand for money, or to an increase in loans by private banks. They hope it is the latter, but it may be a combination of both.

Under Section 5d of the R.F.C. Act the Corporation made 1,949 authorizations to business enterprise in the third quarter of 1938 as follows: authorizations, together with increases in previous authorizations, totaled $56,320,092, of which $34,839,393 were loans and $21,480,699 were purchases and agreements to purchase participations.

Reports to Congress show that 187 loans in November totaled $6,409,703; 270 in October totaled $12,669,300; 313 in September totaled $6,802,416. There were 79 participation purchases in November, totaling $2,188,688; 130 in October totaled $6,827,829; 157 in September totaled $8,455,651.

Outstanding loans to firms in the metal-working industry in November: New Process Twist Drill, $22,000; Hupp Motor Car, $900,000; Johnston & Jennings, $173,000; Kutztown Foundry and Machinery, $10,000; Participations: Sacramento Pipe Works, $50,000; Allsteel Products Mfg. Co., $94,000; Peninsular Metal Products, $32,000; Samuel Stamping and Enameling Co., $37,500.



This 5,500-ton capacity hydraulic press is one of three recently built by Baldwin-Southwark Corp. for forming duralumin aircraft parts. It stands 33 ft. high, weighs approximately 960,000 lb., and requires a total of 400 hp. to operate the pumps. The complete shipment comprised 42 carloads

U. S. MACHINERY MAKERS TO SHARE IN JAP ORDER

TOKYO—American machine tool manufacturers will receive a major portion of new equipment orders totalling almost $3,000,000, it was revealed recently. Involving over 300 units of precision machine tools for a new aircraft plant of the Kawasaki Aircraft Co., the inquiry is the largest which has been issued in recent months after the sudden let-down in Japanese purchases early last summer.

The kind of machines specified include millers, turret lathes, grinders and many other tools required for engine production. It is said that an understanding has already been obtained from the exchange license authorities that the orders may be definitely placed.

Estimated amounts of the $2,800,000 order, as distributed over countries of manufacture are: American, $1,540,000; German, $980,000; British, $140,000.

NATIONAL DEFENSE ISSUE TO FEATURE SAE MEETING

DETROIT — National defense will constitute the theme of the annual meeting of the Society of Automotive Engineers to be held in Detroit's Book-Cadillac Hotel. High-lighting the meeting is "National Defense Day," Wednesday, Jan. 11, which will be climaxed by the annual banquet.

B. C. Heacock, president Caterpillar Tractor Co., toastmaster, will introduce Brig.-Gen. C. T. Harris, Jr., assistant to the chief of ordnance, who will discuss "Industrial Mobilization for National Defense". With him on the program will be S. A. E. president C. W. Spicer, vice-president Spicer Mfg. Corp., and president-elect W. J. Davidson, diesel division of the General Motors Corp.

ARMY TO SPEND MILLIONS ON MUNITIONS MACHINERY

WASHINGTON—The United States Army intends to buy $33,500,000 worth of special munitions manufacturing equipment, to be "held for use in an emergency," according to Major General C. M. Wesson, chief of ordnance.

Machinery for powder-making and shell-loading plants, manufacture of small arms ammunition and casting of cannon is included in the plans. The first grant of $3,700,000 is being expended during the current fiscal year.

General Wesson stressed the importance of such preparations, emphasizing that war-time production of munitions would be seriously hindered because of the time necessary to produce much of the special machinery required. Although six manufacturing arsenals now supply most of the army's munitions demands, in time of war private industry would be faced with the necessity of producing 90 per cent of American military requirements, General Wesson pointed out.

FIRST STRATOSPHERE PLANE BEING TESTED

SEATTLE—Designed for a speed of 300 miles per hour at an altitude of 20,000 ft., the 33-passenger "Stratoliner" recently completed by the Boeing Aircraft Co. is undergoing tests prior to delivery to Pan-American Airways.

The new ship, known officially as Model 307, is the first of a fleet of supercharged high-altitude land planes being built for Pan-American. The plane has a wing spread of 107 ft., a length of 74 ft., and a gross weight of 42,000 lb. It is powered with four 1,100-hp. motors.

The four record size single-stage, double-suction centrifugal pumps now under construction for the Racine Ave. pumping station, Chicago, require 7-ton cast iron rotors like that shown on the boring mill of the Milwaukee plant of the Allis-Chalmers Mfg. Co.

Britain Considers Mobilizing Industrial Resources to Facilitate Rearmament Program

LONDON — Britain's unpreparedness for war, exemplified by its recent stand in European crises, has resulted in agitation for complete industrial mobilization on a scale sufficient to meet the demand of its heavy rearmament program. That some such scheme will be put into force in the near future appears inevitable, but it is difficult to forecast the exact form it will take, and there is reported to be some disagreement in Government circles as to how far it will be necessary to go.

EXPORT SAFEGUARDS NEEDED

Government orders have not always received priority in the present industrial set-up, and before it can be changed it is realized that some means will have to be devised for safeguarding machine-tool as well as other export trade which has already suffered from the pressure of rearmament work. To some extent the Government's task in this respect has already been eased by the falling off in general industrial activity which has been responsible for the extensive liberation of industrial resources, both of plant and labor.

At the beginning of the rearmament program, the machine-tool industry was one of the least organized, there was no trade association in existence, and orders were allocated by the Government with no special effort to obtain quick delivery; however, the Machine Tool Manufacturers' Association, which by no means comprises the whole industry, was recently formed to facilitate rearmament activities.

MACHINE TOOL SHORTAGE ABATED

Complaints of a machine-tool shortage were made throughout 1936 and 1937, and imports, obtained mainly from Germany and the United States, rose from 7,765 tons valued at £1,701,719 in 1935 to 31,579 tons valued at £6,210,085 in 1937. The degree to which the industry devoted itself to armament work to the exclusion of its normal trade may be gaged in part from the decline in exports from 16,446 tons in 1935 to 11,900 tons in 1937. In 1938, extensions of plants by several firms in the industry and the decline in the normal industrial demand in the home market have begun to take effect, and although there has been no decline in armament orders, exports have increased while imports have been declining.

AVERSE TO LABOR CONSCRIPTION

A further difficulty to be faced by the Government is that any scheme for full industrial mobilization must involve a considerable degree of labor conscription, which is bound to cause an acute political controversy. In order to meet this difficulty there has been a considerable amount of thought devoted to broadening the basis of the Government to include a number of certain Trade Union leaders, but no practical steps in this direction have yet been taken.

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

Initial irritation of business men over appointments of Hopkins and Murphy decreases with better understanding of their actual purposes.

WASHINGTON — Appointment of Harry Hopkins as Secretary of Commerce made business representatives here pretty mad when they first heard of it. But later on they decided it might actually replace the old filter through which their problems reached the White House with a direct pipe line. Not that the President's heart is softening toward business, but it would be swell for him if he could round up the business men's votes as he has the farm and labor vote. He needs more support for his continued "liberal" policy.

Business is not overly annoyed as Governor Frank Murphy "sits down" in the Attorney General's chair. The job is chiefly to furnish satisfactory opinions to the Administration. Mr. Cummings did that beautifully and Murphy can do no worse. His office has only one oar in business just now: the anti-trust investigation by T.N.E.C., and that will go forward anyway under Thurman Arnold—for better or worse.

If T.N.E.C. (anti-monopoly committee) gets sufficient appropriations, the investigation will run on for perhaps a year. Next up, after patents, for vivisection will be insurance, steel, and maybe interlocking directorates. Some observers think T.N.E.C. will write an initial report on patents to impress Congress with its potentialities. But this would be risky. Efforts to revise the patent laws have been failing for many years, and Congress may still be cool to any radical change.

The "anti-rubber stamp" conservatives in Congress, as a result of the right swing in elections, will try to shut down on the old priming pump as well as on Mr. Roosevelt's "liberalism." But they will succeed only in a limited measure. Washington thinks the Administration's campaign for big armament money will go through after a bitter debate against those who don't think the country needs it.

NEW DEFENSE PLANS

National defense in the rough, before Congress puts finishing tools to it: The President lays down a new concept of defense for the double-continent instead of the U. S. and possessions; thus the Army would become an expeditionary force as well as the Navy. Objectives: (1) to mobilize industry for full emergency production (2) to build a big air force of 12,000–15,000 planes or to create big plane production capacity (3) to enlarge the Navy to or beyond treaty strength (4) to increase coastal defense (5) to build air and mechanic manpower from colleges and youth groups (6) to enlarge all branches of the Army.

Actual *production* of aircraft and armament, as opposed to building *capacity for production* will be a line of cleavage in congressional debate over defense. The new dealers will want big production to keep money flowing out to business and to labor voters. The conservatives will emphasize industrial mobilization, educational orders, and expansion of both government and private plants—all for big capacity.

TAXES—"AS ADVERTISED"

Congress will follow the President's thoughts about more spending —but will try to take charge of directing it, instead of just voting lump sums. But pork grease is mighty slippery, and the boys may wind up without a firm grip on the controls. One thing is certain: tremendously increased spending—and higher taxes. The President's new alibi for higher taxes—making religion dependent upon national defense — will remove what little chance the small Navy crowd had of paring down preparedness spending.

Business men will do well to look before they leap on Roosevelt's conclusion that social reform is now accomplished, and hence recovery is the immediate necessity—recovery to an $80,000,000,000 income, with the crying need to combine unemployed capital with idle labor.

Reform has marched for six years, but it is only dressing ranks before the new command comes. Thurman Arnold isn't even putting his reform gun at ease; he is pressing on toward new legal restraints to make the world of business safe for the guileless. But Congress isn't paying too much attention to him. In fact, Congress may easily make the parade rest of reform a real bivouac. But the great white father won't like it, and there will be plenty of fireworks as he tries to get the troops moving.

FIFTY SHIPS A YEAR

The Maritime Commission announces about $130,000,000 in ship construction contracts were let during the calendar year 1938 for a total of 51 "bottoms." Context of the handout implies the Commission is rolling along on its 50-ships-a-year schedule, but it is really more than a year behind time. The first launching under the subsidy program, announced for Jan. 7, is a Standard Oil tanker which would have been built regardless of the Commission, and whose only connection with the government is subsidized defense features. The first launching under the Commission's program will be a standard C2 cargo boat about April 15. Shipping men say the Commission is doing a fine job of engineering.

The Wage-Hour Division is now doing what it can to catch up on its industrial committee program, pending allotment of more working funds by Congress, which will not be till some time in February. The Budget Bureau estimates $3,350,000 for the Division in 1940, compared with the $400,000 it got for fiscal 1939, which is being stretched. Of immediate importance is the need for deficiency authorization, which is not in the budget but which Congress will undoubtedly grant. The aim of further Division studies will be to cover the field of "what people wear" and home fabrics before it goes to other industries. So far it has got nowhere with prosecutions. But violations also appear insignificant.

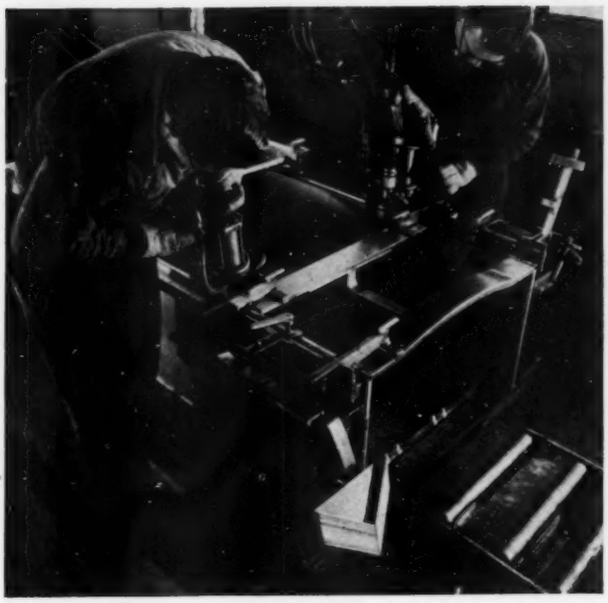
STEEL PRICES, WAGES

Steel prices and their effect on the national economy is the information sought by the Department of Justice and the Federal Trade Commission in sending questionnaires to 54 steel companies. The basing point system also will be appraised. Observers here believe it will not be disturbed.

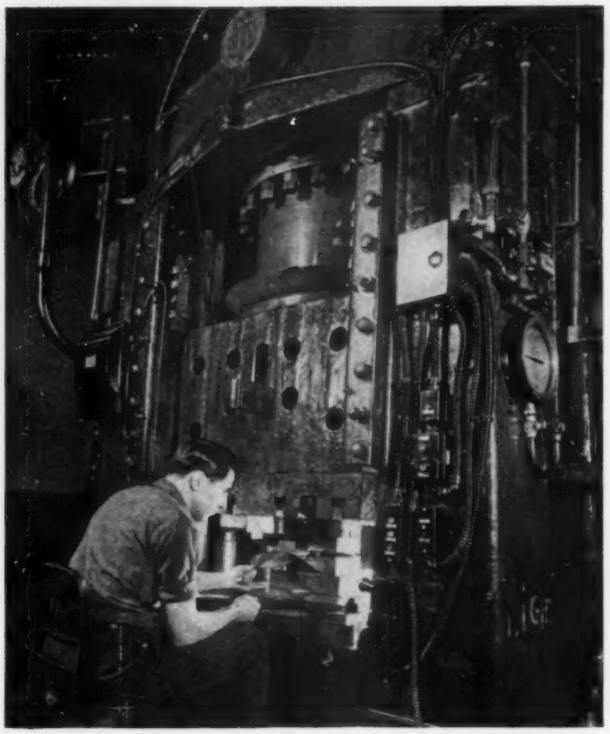
Two regional steel wage rates will be ordered soon under the Walsh-Healey Act by the Labor Department, Washington believes, and the order will be suspended immediately so that the little companies can petition for exemption. Observers say the order is aimed primarily at Bethlehem.

SAME OLD STORY

"Postage stamp" passenger fares to solve the railroad problem fail to excite old Washington sideliners. They've heard it argued time and again during the last 20 years. They say Wheeler asked the I.C.C. to write a report on it (the John A. Hastings plan) as a polite means of slapping it down. Meanwhile Congressional leaders prepared to tackle the rail dilemma by splitting it in two. First they would put the rails under the bankruptcy act and thus under S.E.C., so that they could enter compositions without consent of their creditors. Second part of the program, rehabilitation of the roads, would be hurried through Congress, steering clear of jurisdictional committee fights if possible.



Electric refrigerator and range makers will be busy this year supplying 1,500,000 refrigerators and 360,000 ranges which it is estimated Americans will buy, says F. B. Williams, Jr., Westinghouse vice-president. Take a peep into Westinghouse's electric range division at Mansfield, Ohio, (right) where ribs for Corox heaters are being stamped on a 1,000-ton hydraulic press. One of the operations in forming the bottom compartment of a



Westinghouse refrigerator is shown at the left. A welding buck fits around the carbinet to hold various parts in position for hand welding operations

Plan to Finance Sales of Machinery Revealed

NEW YORK—Sabin St. Germain, Inc., 21 West St., New York, has announced that it now is in a position to finance, through private sources, time shipments of all types of machine tools, woodworking machinery and other industrial equipment to Latin American countries. Arrangements with the company's associates in New York and Latin America are such that the American manufacturer is given irrevocable credit with the order payable upon presentation of documents at New York. Being privately handled, negotiations often can be concluded more rapidly than when financed through other sources.

The growing demand for American-made industrial equipment in all countries south of the Rio Grande can be expected to continue, even in the face of strong competition offered by German and Swiss manufacturers, according to Mr. St. Germain who recently returned from a visit to a number of industrially active South American countries. He reports that the principal users of all types of such equipment are willing to pay the higher cost of high-quality American-made equipment, providing satisfactory credit terms can be arranged. The plan offered by this company is designed to supply this needed credit.

BATTLE SEEN OVER INCENTIVE TAXATION BILL

Discussions of Profit-Sharing Plans Beneficial, Many Feel

WASHINGTON—Senator Arthur Vandenberg, co-chairman of the "Profit sharing" investigating committee, and a few others still believe that incentive taxation will elbow its way into the next revenue bill. Most Washington tax authorities disagree with him. It just sounds un-American to them, and it tastes of special privilege for a few, penalty on the many, and poison as an element in government. But while they thus denounce the proposed taxation base, they say that the exhibition of profit sharing plans in the public prints was a good thing. Here are some of interesting examples cooked down to a few sentences.

WAGES TIED TO EARNINGS

Westinghouse's plan is referred to by the committee as exhibit "A" among plans which give employee a flexible wage proportionate to earnings and which do not attempt to manage the worker's money. Company averaged earnings over each three months, raises wages 1 per cent for each $60,000 of business over the "normal" of $600,000. Wages decline on the same base, but those earning under $125 per month are not affected.

Joslyn Manufacturing & Supply Co.'s plan is rated as exhibit "A" among those that attempt to build "estates" for employees. Each employee of three years service earning $4,000 or less must join or leave the company. Each pay-day 5 per cent of worker's wages are deducted and paid into a saying fund, controlled by company-employee joint board. At the year-end company guarantees to pay into fund not less than 10 per cent of net earnings but not more than four times total employee contributions. Fund is used to buy stock; now holds half of company's $1,500,000 preferred shares. Employee leaving company gets all his own contribution with interest and half of company's. If he is disabled or dies his full credit goes to beneficiary. At 60 he retires and draws his share, but the company can pay in eleven annual parts if squandering is to be expected.

INSURANCE PLANS EMPLOYED

Eastman Kodak has paid a wage dividend every year since 1912, except 1934. For every dollar declared above $3.50 a share on common stock for the previous year, a sum equal to ½ per cent of his total wages for the previous five years is paid to the worker, usually in March. In addition to this plan, a sum equal to half the cash dividend is put into insurance and annuity plans. At present, 22,500 employees, or 90 per cent, participate; the rest are barred by the six

General Electric engineers take extreme care in inserting this new 11-section X-ray tube inside its 1,000,000-volt transformer. The radical design of the unit, resulting in spectacular reductions in space and weight, makes possible extensive industrial applications

months service requirement. Company has paid $43,000,000 under this plan.

General Electric started paying an employee pension in 1912. Later on, separate funds were set up, to which company has contributed $41,000,000 and employees $11,000,000; $21,000,000 have been paid out in pensions. Present plan: after payment of $8 on $100 par stock, 12½ per cent of the net profit is distributed among employees earning $4,000 or less. Extra compensation goes to department heads at rate of 2, 3 and 5 per cent depending on importance of work, competitive nature, etc. The profit-sharing plan has given some $100,000,000 to employees since 1916.

Vanadium-Alloys Steel. Beginning in 1923, the company each year-end has determined its working capital, then has set aside 7 per cent of such sum, plus returns on investments and reserve for taxes. Of the remainder, 25 per cent goes to employees, who are graded as to responsibility of position, value and length of service, so that each can be measured in "units" ranging from 10 to 20. Total profit-sharing amount divided by total units for the year gives each unit a percentage draft on the fund.

Hoskins Manufacturing Co., is representative of smaller companies, with only 150 employees. After 6 per cent on capital investment is deducted from profits, 25 per cent of the remainder is set aside for employees. During the past 10 years, the employees have received an average of 30 per cent of their earnings in this way.

MACHINE TOOL EXPORTS SHOW MARKED ADVANCE

WASHINGTON—United States exports of industrial machinery valued at $19,629,659 during the month of November were 4 per cent less than exports for the corresponding month of 1937, according to the machinery division, Bureau of Foreign and Domestic Commerce.

For the third consecutive month the only advance is recorded in exports of power-driven metal-working machinery, which has shown an increase of 34 per cent over the previous November, having advanced to $8,044,476 for the 1938 period. Nearly all items in this group participated in the advance, although shipment of rolling mill machinery was slightly lower, amounting to $795,000 as compared with a previous value of $801,000.

Totalling $301,162, exports of other metal-working machinery declined 18 per cent from the November, 1937 total of $364,664.

November exports of agricultural implements, valued at $4,165,283 compared with $4,567,815 in November, 1937, represented a decrease of 9 per cent, the figures indicate.

Exports of Machinery During November, 1938

	November 1938	October 1938	November 1937
Electrical machinery	$7,947,853	$9,189,618	$9,172,619
Power generating machinery except automotive and electric	1,089,348	1,185,543	1,396,852
Construction and conveying machinery	1,396,215	1,920,823	1,911,374
Mining, well and pumping machinery	4,074,140	4,582,379	4,432,411
Power driven, metal-working machinery	8,044,476	7,513,557	5,988,511
Other metal-working machinery	301,162	326,736	364,664
Textile machinery	653,129	565,109	962,465

Exports of Metal-Working Machinery During November, 1938

Engine lathes	676,641	180,853	474,283
Turret lathes	472,778	454,970	449,716
Other lathes	114,946	176,854	63,227
Vertical boring mills and chucking machines	230,236	126,763	142,492
Thread cutting and automatic screw machines	434,311	268,856	336,318
Knee and column type milling machines	78,754	232,360	478,697
Other milling machines	1,295,353	1,195,864	460,955
Gear-cutting machines	212,181	264,610	164,623
Vertical drilling machines	15,467	17,345	41,677
Radial drilling machines	60,502	54,765	70,561
Other drilling machines	87,702	154,502	204,903
Planers and shapers	194,432	184,634	160,210
Surface grinding machines	160,724	276,113	175,391
External cylindrical grinding machines	171,667	167,084	151,707
Internal grinding machines	236,955	483,403	190,168
Tool grinding, cutter grinding, and universal grinding machines	202,360	284,665	152,586
Other metal-grinding machines and parts	365,398	439,057	229,789
Sheet and plate metal working machines and parts	932,404	539,211	373,565
Forging machinery and parts	197,776	241,627	102,485
Rolling mill machinery and parts	795,146	685,381	801,585
Foundry and molding equipment and parts	110,670	374,149	131,765
Other power-driven metal-working machinery and parts	1,002,073	710,491	631,808

Other Metal-Working Machinery

Pneumatic portable tools	90,944	95,547	124,609
Portable and hand and foot operated metal-working machines and parts	83,766	127,027	104,690
Milling cutters, machinery operated thread dies and taps and similar machinery operated metal cutting tools	67,338	44,533	59,041
Other metal-working machine tools	33,632	37,977	49,069
Chucks for machine tools	25,482	21,652	27,255

MORE JAPANESE MACHINE TOOL PURCHASES SEEN

TOKYO—Continuing imports of machine tools into Japan will be necessary despite mounting exchange difficulties, according to well-informed observers, although the volume may not be quite as heavy as during the first five months of 1938. Notwithstanding the progress that has been made in the local manufacture of machine tools, industrialists do not yet see a possibility of Japanese makers meeting their immediate requirements.

In other quarters it is predicted that beginning with the second half of 1939, orders may gradually decline as the seventeen licensed factories of twelve Japanese machine tool companies, in addition to several non-licensed firms, will, by that time, be ready to operate the primary machine tools which were imported in vast numbers during the past two years.

PERSONALS

HARRY F. KNAPP has been appointed manager of special accounts sales of the Carnegie-Illinois Steel Corp., with headquarters in Washington, D.C. ANDREW J. SNOW has been named sales manager of the Washington District office, succeeding Mr. Knapp.

E. W. SEEGER has been appointed chief engineer of Cutler-Hammer, Inc., Milwaukee manufacturer of electrical apparatus, it was announced recently by W. C. STEVENS, vice-president in charge of engineering. Mr. Seeger became associated with Cutler-Hammer in 1913, shortly after receiving a degree from Ohio State University. During the ensuing 15 years, he was employed in the shop and engineering departments, becoming assistant chief engineer in 1928, a position which he has held up to the present time.

HARRY M. FRANCIS has been named assistant vice-president of the American Steel & Wire Co., a subsidiary of the United States Steel Corp.

FLOYD J. NEAL, formerly manager of the tools and hardware division of the Peck, Stow & Wilcox Co., Southington, Conn., has been appointed manager of production.

FRANK SCHUBERT has been appointed assistant general manager of the Houde Engineering Corp., to succeed the late EDWARD L. VALANCE. Mr. Schubert has been associated with Houde for two years in a sales executive capacity. Previously, he was assistant to the president of the Bearings Corp. of America.

H. F. KNAPP

E. W. SEEGER

R. M. ALVORD, J. E. N. HUME and A. S. MOODY were appointed commercial vice-presidents of the General Electric Co. at a recent meeting of the board of directors, it was announced by Gerard Swope, president. Mr. Alvord is manager of the company's Pacific district, Mr. Hume manager of the industrial department, and Mr. Moody manager of the Northwest district.

ALAN E. ASHCRAFT has been appointed vice-president in charge of all operations in Fairbanks, Morse & Co. plants at Beloit, Wis., Three Rivers, Mich., St., Johnsbury, Vt., San Francisco, Calif., Moline, Ill., and Stuttgart, Ark.

H. V. ERBEN, manager of the switchgear sales division of the Philadelphia works of the General Electric Co., has been appointed an assistant manager of the central station department at Schenectady, it was announced recently by M. O. TROY, commercial vice-president. Mr. Erben is succeeded in Philadelphia by R. F. TINNERHOLM.

E. G. HILL has been appointed assistant to the general superintendent in charge of technological co-ordination at the Gary Works of the Carnegie-Illinois Steel Corp., it was announced recently. F. E. MOONEY has been named assistant to the general production superintendent and J. N. QUINLAN has been made assistant division superintendent of the west mills.

H. FOLLETTE HODGKINS, president Rollway Bearing Co., Syracuse, N. Y., is acting as general manager in place of W. H. Float, who resigned recently.

JAY MORRISON has been named assistant to the president of the Boeing Aircraft Co. ROBERT J. MINSHALL, engineering vice-president, has been appointed assistant general manager. JOHN KYLSTRA has been named chief engineer.

W. T. MONTAGUE has been appointed assistant vice-president of the Norton Co., Worcester, Mass.

ERNEST NIEDERER, recently resigned as works manager of the Clearing Machine Corp., Chicago, has been appointed works manager of the Verson Allsteel Press Co., Chicago press and die manufacturer.

J. P. SPANG, JR., has been elected president of the Gillette Safety Razor Co. He succeeds S. C. STAMPLEMAN, who has been named chairman of the board.

R. C. STUART, general manager of the Barlow & Seelig Mfg. Co., Ripon, Wis., manufacturer of household appliances, has been appointed chairman of the board, according to a recent announcement.

JAMES M. WOODWARD, JR., has been appointed superintendent of bar mills at the Gary Works of the Carnegie-Illinois Steel Corp., it was announced recently.

OBITUARIES

FRANK N. HOFFSTOT, from 1908 to 1933 president of the Pressed Steel Car Co., Pittsburgh, died at his home in New York, N. Y., following an extended illness. He was 77 years of age.

ARTHUR M. MATTISON, president Mattison Machine Works, died Dec. 21 at his home in Rockford, Ill., at the age of 57. He had been president of the firm since the death of his father and company founder, CHRISTEN MATTISON, in 1920.

FRANK C. B. PAGE, retired president of the E. W. Bliss Co., Brooklyn, N. Y., died recently at his home in that city. He was 68 years of age, and had served the Bliss organization for more than 50 years.

GEORGE H. STICKNEY, 46, a member of the engineering department since 1936 and formerly superintendent of the foundry at the plant of the United Shoe Machinery Co., Beverly, Mass., died on Jan. 1.

ROBERT C. DANLY

ROBERT C. DANLY, president Danly Machine Specialties, Inc., Chicago, died Dec. 15 at his home in Hinsdale, Ill. He was 66 years of age.

Mr. Danly was prominent in Chicago's manufacturing activities for the past 46 years, having been associated with the Fanning Cycle Co., the Accurate Engineering Co., the International Harvester Co. and Ludwig & Ludwig. In 1923 he founded Danly Machine Specialties, Inc., and served continuously as president until his death.

FRED C. DUSTMAN, 47, superintendent of the tube mill of the Youngstown Sheet & Tube Co., Youngstown, Ohio, died Dec. 28 at his home in that city following a brief illness.

ALEXANDER J. FORSYTH, head of A. J. Forsyth & Co., Vancouver, B. C., steel importer, died recently at his home in that city.

CHARLES J. SCOTT, former superintendent of the Coatesville Iron Co. and the Worth Bros. Iron Co., Coatesville, Pa., died Dec. 18 at his home in that city.

BUSINESS ITEMS

Allen-Bradley Co., Milwaukee manufacturer of electric motor control equipment, has opened an office in Rockford, Ill. H. L. O'DONNELL, formerly of the Chicago office, has been placed in charge.

Allis-Chalmers Mfg. Co., Milwaukee, has established a new branch office and warehouse in Newark, N. J. Organized as a branch of the New York district office of the company, the new office will be under the management of C. A. PIHL.

The American Society of Tool Engineers will charter two more chapters in the next few weeks. One of these, to include southern New York state, will be in Elmira, N. Y., while the second will be located in Peoria, Ill.

The Eaton Mfg. Co. has acquired the Massillon, Ohio, plant of the former Acme Rubber Co., it was announced recently by J. O. EATON, chairman of the Eaton organization. Containing 25,000 sq.ft. of floor space, the building will be used as a laboratory and warehouse.

Foote Bros. Gear & Machine Corp., Chicago, has appointed the following representatives for its "IXL" gear products and speed reducers: A. C. Andrews, Dallas, Texas; W. M. Lee, Houston, Texas; Industrial Engineering Co., Charleston, W. Va.

The Inland Steel Co. has put into operation a new blast furnace at its Indiana Harbor, Ind., works. Incorporating many design and control improvements, the new unit is capable of producing 1,000 tons of pig iron per day.

King-Seeley Corp., Ann Arbor, Mich., manufacturer of automobile instruments, has acquired the Handy Governor Corp., Detroit, according to JOHN AIREY, president and general manager of the first concern. A. A. BULL, president and general manager of the Detroit company, will become a vice-president of King-Seeley.

Meehanite Metal Corp., Pittsburgh, has granted production licenses to the Perry Engineering Co., Kalgoorlie Foundry Co. and Goninan Co., of Australia, and to the Fleming Foundry Co., Springfield, Mass.

North American Aviation, Inc., Inglewood, Calif., has been awarded a contract for the construction of 74 military observation planes. Fifty of the planes are for National Guard organizations and 24 for the Army. The ships will be single-engined monoplanes, powered by Wright "Cyclone" motors developing 850 hp. Contract price was $2,346,128.

The Packard Motor Car Co. presented 546 veterans of ten years or more with useful Christmas gifts at a recent ceremony in Detroit. Consisting of gold watches for the men and either watches or chests of table silver for the women, the gifts were presented by ALVAN MACAULEY, Packard president. Over 6,000 watches have been presented since 1917, when the company first started the custom.

Horace T. Potts Co., Philadelphia, has appointed Beals, McCarthy & Rogers, Buffalo, and the Equitable Equipment Co., New Orleans, as distributors for its "Elastuf" group of related machinery steels.

Ransome Concrete Machinery Co., Dunellen, N. J., manufacturer of welding accessories, has appointed the Machinery & Welder Corp., St. Louis, Mo., as its exclusive midwestern representative.

The Studebaker Corp. has restored salary reductions which became effective April 1, according to PAUL G. HOFFMAN, president. Cancellation of the cuts applies to all salaried employees except the president and chairman of the board.

Vega Aircraft Co., subsidiary of Lockheed Aircraft Corp., has purchased the Burbank, Calif., plant of the Consolidated National Corp. The structure will provide Vega with 77,000 sq.ft. additional floor space.

The Western Bridge Co., Ltd., of Vancouver, B. C., has been awarded a contract for the construction of a $140,000 airline tramway for Algoma Ore Properties, Ltd., it was announced recently by COL. J. P. MACKENZIE, general manager, and A. McB. BELL-IRVING, comptroller of Western Bridge.

MEETINGS

AMERICAN ENGINEERING COUNCIL. Nineteenth annual assembly, Jan. 12–13, Mayflower Hotel, Washington, D. C. Executive secretary, F. M. FEIKER, 744 Jackson Place, N. W., Washington, D. C.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Winter convention, Jan. 23–27, New York, N. Y. H. H. HENLINE, secretary, 33 W. 39th St., New York, N. Y.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. Annual meeting, Palmer House, Chicago, Ill., March 14–16. W. S. LACHER, secretary, 59 E. Van Buren St., Chicago, Ill.

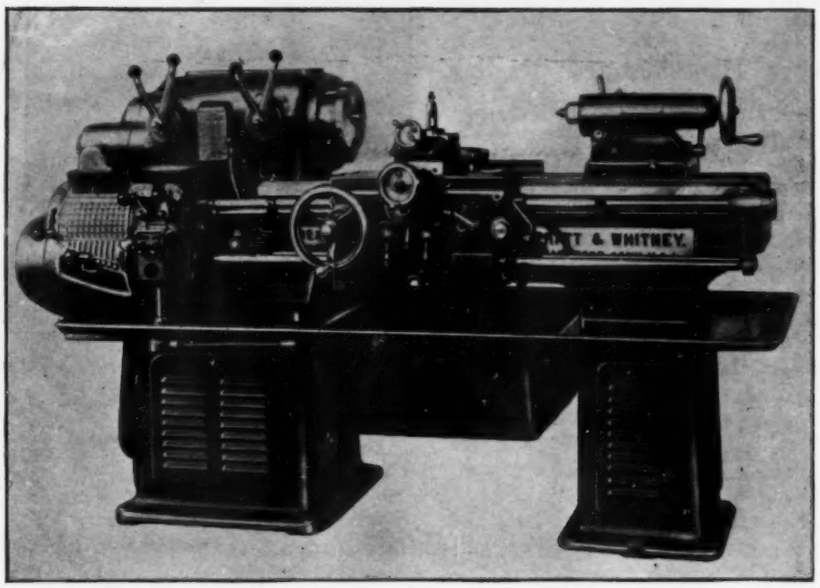
AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, Jan. 18–21, New York, N. Y. Society secretary, GEORGE T. SEABURY, 33 W. 39th St., New York, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Annual meeting, Jan. 23–26, William Penn Hotel, Pittsburgh, Pa. A. HUTCHINSON, secretary, 51 Madison Ave., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Regional meeting, Deshler-Wallick Hotel, Columbus, Ohio, March 6–10. Arrangements committee chairman, W. W. HEIMBERGER, Buckeye Steel Castings Co., Columbus, Ohio.

AMERICAN SOCIETY OF TOOL ENGINEERS. Annual meeting and Machine & Tool Progress Exhibition, Convention Hall, Detroit, Mich., March 14–18. FORD R. LAMB, executive secretary, Room 428 Boulevard Temple Bldg., 2567 W. Grand Blvd., Detroit, Mich.

MOTOR AND EQUIPMENT MANUFACTURERS ASSOCIATION. Southwest automotive show, Coliseum, Houston, Texas, Jan. 12–15. Manager, N. M. JOHNSON, 1133 Liberty Bank Bldg., Dallas, Texas. Automotive maintenance show, Palace of Fine Arts, San Francisco, Calif., Feb 23–26. Manager, J. M. Noble, 1243 S. Hope St., San Francisco, Calif.



Pratt & Whitney 12-In. Lathe Has Eighteen Spindle Speeds

Although rated as a 12-in. lathe, the new Model C lathe announced by Pratt & Whitney, Div. Niles-Bement-Pond Co., Hartford, Conn., has a swing over the bed of 14½ in. This lathe has eighteen spindle speeds arranged in smooth geometric progression up to 1,500 r.p.m. It is available in two lengths, having center to center capacities of 30 and 54 in. respectively.

Like the larger machines of this type, the constant speed driving motor is mounted in a cabinet leg under the headstock and is provided with a hinged platform with a screw adjustment for belt tightening. A fully inclosed three V-belt drive connects to the main driving pulley at the rear of the headstock. A 3 hp. constant speed, 1,800 r.p.m. ball-bearing motor is used. Electrical controls are mounted in a cabinet leg under the tailstock, while the push-button control station is mounted on the quick change gear box.

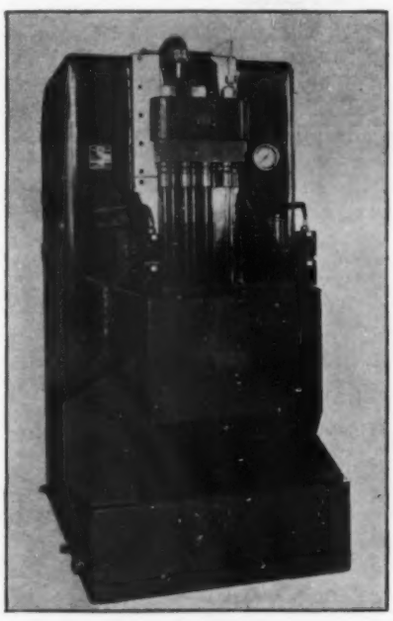
The spindle is mounted in three precision bearings, the two at the front being ball bearings, and the third at the rear is of the precision roller type. The rear of the headstock and the bed are built up to form what is known as a column headstock. This gives support to the driving pulley and does away with excessive overhang. Oil used for lubricating the spindle bearings and gears is passed through a filter at the rear of the bed and the oil reservoir in the bed is of sufficient size to maintain the oil cool under continuous operation.

The spindle nose is of the flanged D-1 type and is of the "cam-lock" design. The quick change gear box provides for 60 changes of feed ranging from 0.0025 to 0.52 in. It also provides for 60 thread changes from 1 to 60 threads per inch inclusive. A direct reading index plate permits rapid setting and checking of threads or feeds. A synchronizing high-speed clutch mechanism incorporated in the headstock for reversing the lead screw and feed rod drive makes it possible to reverse the carriage at higher speeds without stopping. The lever controlling this mechanism is on the right-hand end of the apron and has a vertical movement with three positions.

Balanced Cutting Featured In American Hydraulic Broaching Machines

The Type VP vertical pull-up internal hydraulic broaching machines offered by American Broach & Machine Co., Div. of Sundstrand Machine Tool Co., Ann Arbor, Mich., are built in several different sizes and tonnages to suit a wide range of internal broaching operations. They can be arranged either for semi-automatic or full-automatic service. The moving or sliding member on the machine is the broach pulling cylinder slide, which is provided with square lock type ways cast integral with the cylinder. The weight of this slide is claimed to produce a balancing effect on the cutting tools. The result is a smooth steady action which prolongs broach life.

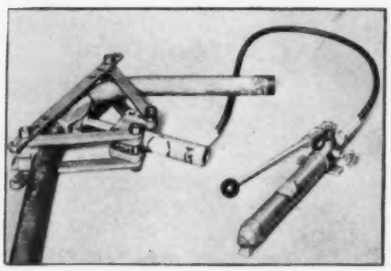
Standard hydraulic equipment includes a Sundstrand variable-delivery pump and a small auxiliary pump of the constant delivery type for operating the broach elevating cylinder. The intake ports of both pumps are



protected by oil filters. Height of work plate above the floor in these machines ranges from 50 to 68 in., and capacity is from 14 to 25 tons.

"Porto-Power" Kits Have Wide Application

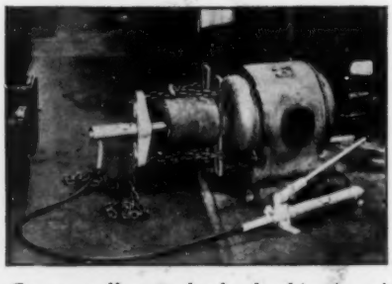
"Porto-Power" hydraulic assortments, furnished in separate kits for specific types of application, include a portable hydraulic unit consisting of a pump, hose and ram. The pump forces oil through a 6 ft. high-pressure flexible hose to the 10 ton ram, which is equipped with threads in three positions for the attachments of tools of various types. Combined weight of the pump, ram and hose is 26 lb.; the ram weighs only 10 lb. Offered by the Blackhawk Mfg. Co., Milwaukee, Wis., these kits include attachments specially developed for



The Type S-30 "Porto-Power" pipe bending kit will operate in any horizontal, vertical or angular position. Angle bends and offsets are formed without kinks

particular applications. The No. S-30 kit for pipe and conduit bending includes the Type S-71 pump, ram and hose, and accessories for cold bending and straightening standard steel conduits, tubes and standard pipe of 1 and 2 in. diameters. Necessary bending shoes, pivot shoes, tension arms, anchor pins and an adjustable ram head are included.

Kit No. S-31, for maintenance work, contains the Type S-71 hydraulic unit and 20 attachments, which include extension tubes, lengths of chain, chain plates, tube couplings, pusher heads, clamps heads and similar units. Bushings, pins, bolts and shafts can be inserted or removed with this kit, as can gears, pulleys and wheels. It also is suitable for clamping parts for welding, drilling, riveting and assembling.

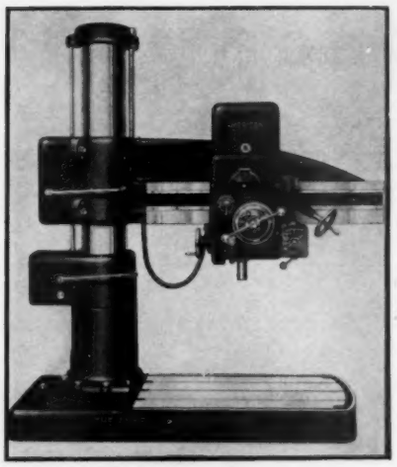


Gears, pulleys, wheels, bushings and pins can be inserted or removed with the Type S-31 "Porto-Power" hydraulic maintenance kit

New "Hole Wizard" Radial Useful on Boring Set-Ups

Latest addition to the "Hole Wizard" line of radial drills is the 11-in. diameter column design which comes in arm lengths of from 3 to 6 ft. In addition to speed and economy on ordinary drilling and tapping operations, these machines are especially suited to accurate boring such as is frequently encountered in toolrooms and die shops. According to the manufacturers, the American Tool Works, Cincinnati, Ohio, this precision is achieved by a stabilized spindle construction.

The machines are driven by 5-hp. ball-bearing motors. Spindles and sleeves are of "Nitralloy" steel, nitrided to give high surface hardness. The sleeves are honed to give a precision mounting to the ground spindles. Timken bearings are used on the driving sleeves, top and bottom, with take-up for wear.

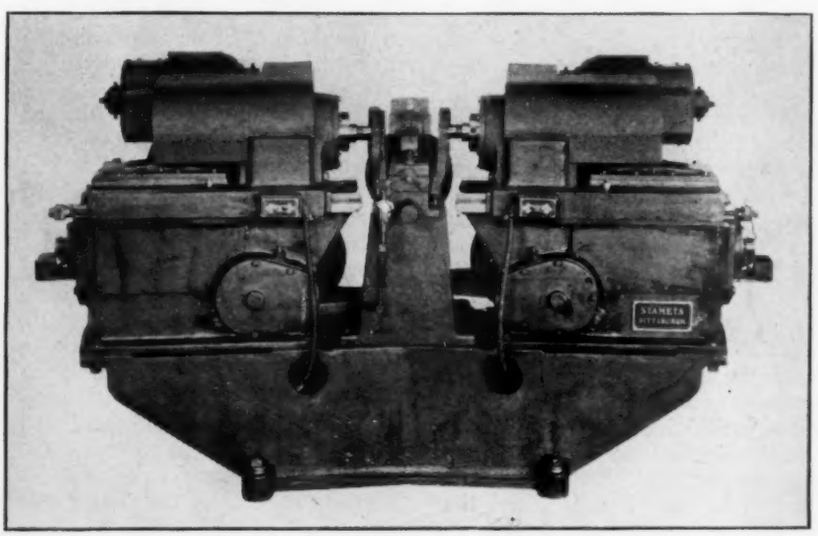


There are twelve spindle speeds. The standard range is from 50 to 1500 r.p.m. in geometrical progression. If higher speeds are desired the entire range may be stepped up to 70–2,100 r.p.m. or 100–3,000 r.p.m. by means of pick-off gears. Six power feeds, varying from 0.004 to 0.025 in. per revolution of the spindle, are obtained through a sliding gear unit. Controls are conveniently centralized.

Stamets Double-End Machine Bores and Back Faces Valve Bodies

A special machine for boring the water way and back-facing the seats in valve bodies in sizes from ¾ to 2 in. has been developed by William K. Stamets, 4026 Jenkins Arcade Bldg., Pittsburgh, Pa. The machine consists of a base which supports two boring heads swiveled about the center of the machine, so that the heads can be set in line or at an angle to each other.

Mounted in each carriage is a boring spindle which carries an arbor and a tool holder so disposed as



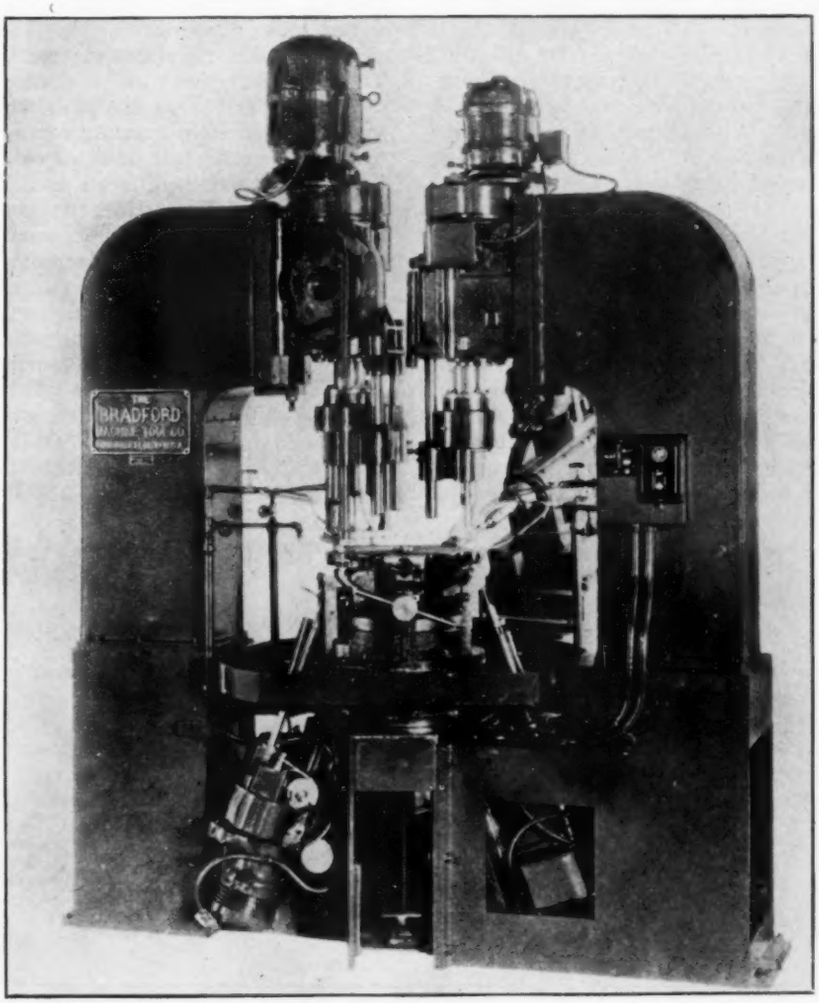
to provide a compound eccentric, so that when the arbor is rotated in the spindle the cutting tool moves radially with respect to the center line of the spindle. This arrangement provides a close balance of the rotating parts, so that high speeds proper for tungsten-carbide tools can be used.

Mounted on each carriage is a slide which carries a nut engaging the rear threaded portion of the arbor, so that when the slide is moved it rotates the arbor to provide cross feed for the cutting tool. Both the carriage and the carriage slide are moved by means of a drum cam. The valve seats can be faced flat or slightly conical. A roughing and a finishing cut can be taken when back-facing.

Bradford Automatic Drilling Unit Has Six Standard Drilling Heads

Drilling, facing, counterboring, core drilling and tapping operations are performed on the oil pump bracket, used on a popular automobile, in this semi-automatic machine designed and built by the Bradford Machine Tool Co., 657 Evans St., Cincinnati, Ohio. The machine is made almost entirely of normalized welded steel units, with the exception of the housings of the heads and the fixtures. A five-station horizontal index table carries the quick-acting type fixture which hold one part at each station. Three inverted drilling units, with sealed spindles, are brought up to the work through the chip and coolant trough and the parts are held underneath the fixture table, rather than on top of it. All movements are synchronized by limit switches and relays; control is through pushbuttons.

The machine performs the following operations: Station No. 1, load and unload; station No. 2, drill two holes from above and one hole from below; station No. 3, counterbore two holes from above and spotface; station No. 4, core drill one hole at a 15 deg. angle from horizontal; station No. 5, tap two holes from above and one hole from below. Based on an operating efficiency of 85 per cent, production is 150 pieces per hour.

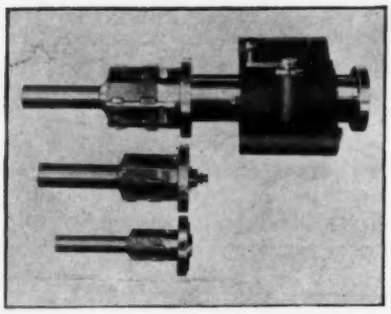


"Square D" Breaker Withstands Weather

The Type M Raintight "Multi-BreakeR" unit developed by the Square D Co., Detroit, Mich., is intended for use in outdoor applications. The box and cover are made of "galvaneal" steel and have a baked aluminum finish. Conduit hubs can be provided in the top or bottom, or both in sizes to meet the usual requirements. Various combinations of breaker units can be mounted in this control box.

Collapsible Tap Used For Boring and Tapping

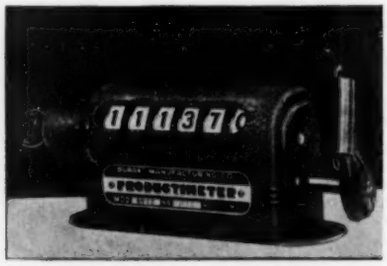
The Style LBSR expanding chaser collapsible tap announced by Landis Machine Co., Inc., Waynesboro, Pa., was designed for the production boring and tapping of flanges where it is necessary to tap from the small diameter to the larger diameter. The tap was engineered for application to the Gisholt "Simplimatic," although it can be adapted to other machines which are used for similar operations. As shown in the illustration, a boring and tapping head are mounted tandem on the tap body to provide for taper boring the hole and tapping the thread in one pass of the tool. A pilot bar attached to the boring head, and fitting a bushing in the machine spindle, supports the tap and secures proper alignment with the work. An oil ring, which directs the flow of cutting coolant to the cutters, is an integral



part of each tap head. The design permits using several sizes of tap heads on one tap body; the illustration shows an 8 in. head mounted on the tap body and additional heads for 4 and 6 in. diameters. Two sizes of bodies are available.

Series H Productimeters Have Oilless Bearings

Including stroke and revolution counters in 20 variations to suit practically any industrial application, the Series H Productimeters announced by Durant Mfg. Co., 655 Buffam St., Milwaukee, Wis., can be fitted with tumbler locks to prevent unauthorized resetting of the count. All shafts run in oilless bearings. Cut gears and

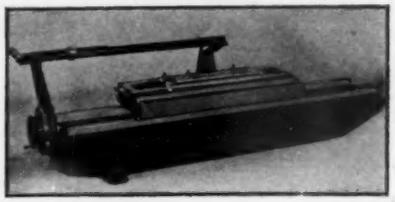


working parts are carefully fitted to insure accurate operation. These counters are available in stroke or rotary models; non-reset, wing-nut reset, or tumbler lock reset; operating levers on right or left; shaft extensions on right or left, or both ends; five or six figures; and with rotations clockwise or counter clockwise.

Mico Offers a 24-In. Measuring Engine

Primarily a single-coordinate measuring device with a range of 24-in. that can be converted to a two-coordinate measuring engine by the addition of a cross carriage that permits 6 in. of measured motion, this 24-in. measuring engine developed by Mico Instrument Co., 10 Arrow St., Cambridge, Mass., has a rigid bed casting that has been aged thoroughly before final machining. As a single coordinate unit, it can serve as a comparator, a micro-densitometer, or a ruling engine of high precision.

The carriage, which is 27 in. long and 10⅛ in. wide, rolls on ball bearings on a 90 deg. V and a flat. The 6½ in. diameter dial is graduated in 1,000 divisions and reads directly to microns when a metric screw is used, and to 0.00005 in. when a screw having 20 threads per inch is used. The observing microscope has its oscular at the dial end of the instrument in order to minimize the effect of temperature changes.



Lewis No. 20-F Shape Straightener Has a Flying-Shear Type Cut Off

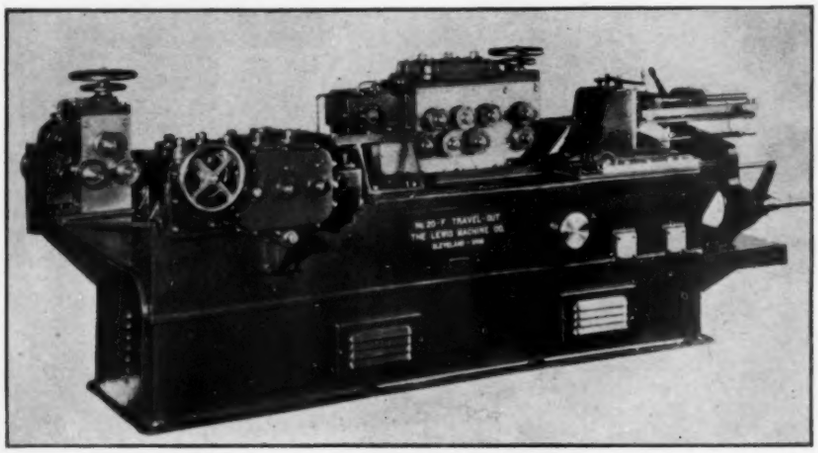
All rolls are power-driven in the No. 20-F "Travel-Cut" shape straightening and cutting machine offered by the Lewis Machine Co., 3441 E. 76th St., Cleveland, Ohio. This machine is designed to handle square, flat, hexagon and shaped rods and is equipped with a flying shear type cut-off unit. It has capacity for ⅝ in. square or equivalent area and will take flats up to 2½ in. wide. Simple adjustment of the gage permits cutting of any length required up to the maximum cutting length of the machine.

The rod is taken from the coil, runs through the three-roll preliminary flat straightener which removes the coil bow, passes through the two horizontal feed rolls and six edge straightening rolls, then through the six flat straightening rolls and comes out from between two vertical rolls perfectly straight. It then is guided through the cut-off head and on into the guide bar where it trips the clutch by striking a gage wire which has been set for a pre-determined length. After tripping the clutch, the rod moves forward to a positive length gage traveling with the cut-off head, where it is gaged accurately before being cut. The cut-off head, traveling with the rod, cuts while in motion and produces rods free of roll marks. Drive to this machine is from a 30 hp. motor through multiple V-belts.

Two Devices Improve Air Tool Operation

A combination of an air strainer and the sight feed automatic air line lubricator, both offered by C. A. Norgren Co., Inc., Denver, Colo., is designed to condition air for the efficient operation of pneumatic tools. The strainer consists of a double screen, a bronze head and a drawn steel bowl. Effective straining area is five times greater than inlet or outlet openings and there is no restriction of air flow. The strainer removes dirt, scale and other impurities from the air stream and traps approximately 92 per cent of the moisture. It is available in ¼ and ⅜ in. sizes.

The improved sight feed automatic air line lubricator has a transparent oil reservoir of resilient plastic which will not chip, strain or shatter, and withstands the Underwriters' 500-lb. burst test. It is suitable for installations with temperatures up to 180 F.



Picture of a Man Earning More Money for Himself and His Company

He is able to earn more because his far-sighted boss replaced an old, worn-out wobbly drill with a new Buffalo No. 18 Drilling Machine.

Its extra heavy standard assures vibrationless operation, reduces operator fatigue.

Its chrome-nickel alloy spindle is turning out *accurate* work.

Its easy operation enables operator to do more and better work.

In short, it pays a better profit to operator and plant owner.

And the price on Buffalo 18 Drills is less than you would expect for such fine performance.

Write today for Bulletin 3123

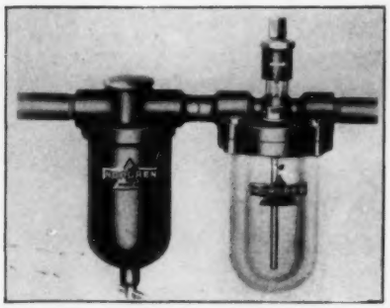
BUFFALO FORGE COMPANY

448 Broadway **Buffalo, N. Y.**

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" **No. 18** DRILLING MACHINES

The oil feed is controlled by an adjustable needle valve which is in plain sight and reveals the amount of lubricant being introduced to the air stream. This lubricator is available in $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in. sizes for horizontal lines



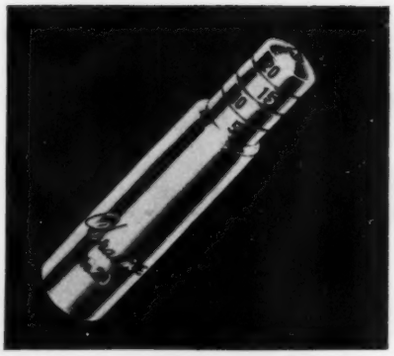
Weston Clamp-Ammeter Combines Six Ranges

The improved bakelite-encased a.c. clamp-ammeter, announced by Weston Electrical Instrument Corp., Newark, N. J., combines six ranges in one instrument, and will measure current flow through conductors up to $2\frac{1}{4}$ in. in diameter, whether insulated or non-insulated. Actual full scale ranges

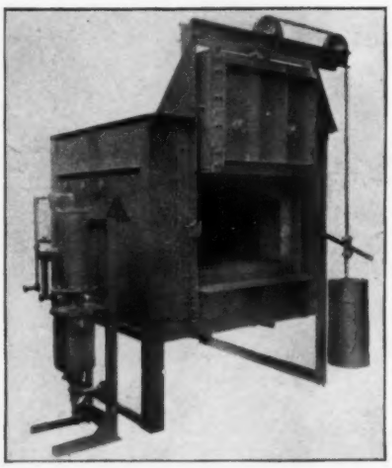
are 10, 25, 50, 100, 250 and 500 amp. Any one of these ranges may be selected by use of an easily-operated range changer located at the thumb position. This instrument, listed as Model No. 633, has a specially designed magnetic circuit which permits only the conductor within the clamping jaws to influence the indications of the instrument.

Abrasive Dresser Has "Oxide-Free" Mounting

An oxide-free mounting process, which involves the heating of the diamond in a multimetal matrix without the limitations of a closed furnace, is used for mounting the diamonds in the improved diamond dressing tools, offered by Abrasive Dressing Tool Co., 1550 Broadway, Detroit, Mich. The diamonds, being heated in the absence of oxygen and



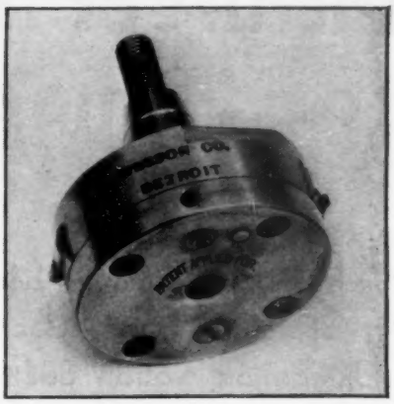
for only 20 sec. are claimed to be completely protected from any harmful chemical reactions and do not lose their hardness and strength. The No. 20 cluster-type dressing tool shown is recommended for medium sized wheel dressing. There are four layers with five diamonds to each layer.



New Electric Furnaces Can Be Used Up to 1,850 F.

Improved electric heat-treating furnaces developed by the Industrial Furnace Div., The Philadelphia Drying Machinery Co., 3351 Stokley St., Philadelphia, Pa., can be used for any heat-treating operation up to a maximum temperature of 1,850 F. They are equipped with nickel-chromium heating elements on both side walls and under the alloy hearth plate. The door has a sand seal at the bottom and clamps are provided at each side.

For clean annealing or scale free hardening, these furnaces are equipped with a gas atmosphere unit having flow gages to assist in setting the burner on the combustion chamber to deliver an atmosphere suitable for the work being treated. The furnace shown has a 30 x 36 in. hearth and the door opening is 30 in. wide and 18 in. high at the spring of the arch. The connected load is 54 kw. An atmosphere unit is shown beside the furnace.

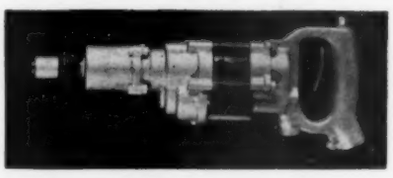


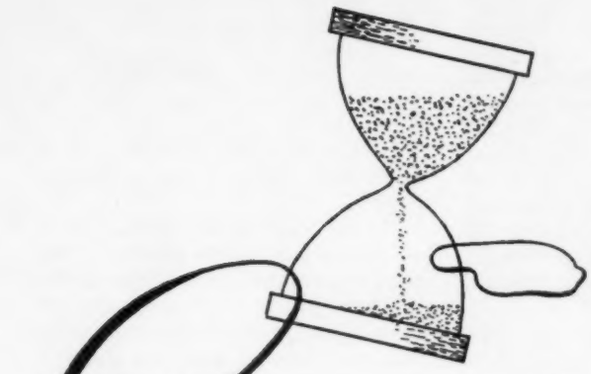
Wesson Boring Head Is Collapsible

Increased accuracy in sizes, roundness and straightness of bored holes, together with a high quality finish and increased production, is claimed for the fully-automatic collapsible boring head developed by Wesson Co., 1050 Mt. Elliott Ave., Detroit, Mich. These heads are positive in action and use two or more solid tungsten-carbide tool bits. The collapsible feature eliminates the need for stopping or positioning spindles and indexing the part to prevent scoring the machined surface on the return stroke.

Rotor Tool Clutches Provide Uniform Tension

A group of adjustable, triple-action impact clutches for use on pneumatic nut setters and screw drivers ranging in capacity from $\frac{1}{4}$ to $\frac{3}{4}$ in., have been announced by the Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio. These clutches apply the impact principle to increase the turning effort of the clutch. First, the torque of the motor drives the nut down, then the triple action clutch gives three impacts per revolution to set the nut to a uniform, predetermined tension. The torque at which the nut is set and the clutch released is governed by an adjustable spring. The illustration shows one of these clutches mounted on a Type E-1C nut setter of $\frac{1}{2}$ in. capacity.





THE Experience OF AN ENTIRE INDUSTRY goes into Each Job!

That *your* product, which is *his* only product might be better fitted for *its* job, your local commercial steel treater continuously supplements his own already vast experience with the knowledge and experience of many other commercial heat treating organizations throughout the country. Through constant exchange of ideas, and discussion of methods, the industry builds its log of experience. A problem in San Francisco, for example, is quickly worked out because a similar problem came up in New York months ago.

Your commercial steel treater has been important to the development of practical metallurgy in this country. New methods—new processes and new equipment have been developed in his plant and your product is being handled more accurately and economically because he is alert and progressive.

He has the most modern equipment available, a highly specialized personnel—and a background based on the heat treatment of hundreds of different steels every week of the year, day and night. Call in this man and get his figures on your work today. Because he operates continuously he can serve you at a saving and *always* delivers accurate work, on time.

MTI
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Cook Heat Treating Corp., Los Angeles
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Perfection Tool & Metal Heat Treating Co., Chicago
Fred A. Snow Co., Chicago
O. T. Muehlemeyer Heat Treating, Rockford
C. U. Scott & Son, Rock Island

Massachusetts
Norfolk Hardening Works, Inc., Boston
New England Metallurgical Corp., So. Boston
Porter Forge & Furnace, Inc., Everett

Michigan
Acme Steel Treating Company, Detroit
Commonwealth Heat Treating Co., Detroit

New Jersey
American Metal Treatment Co., Elizabeth

New York
Fred Heinzelman, New York City

Ohio
The Queen City Steel Treating Co., Cincinnati
The Lakeside Steel Improvement Co., Cleveland
The George H. Porter Steel Treating Co., Cleveland
The Dayton Forging & Heat Treating Co., Dayton
The Ohio Heat Treating Company, Dayton

Pennsylvania
Wiedman Machine Company, Philadelphia
Robert Wooler, Philadelphia
Pittsburgh Commercial Heat Treating Co., Pittsburgh

Wisconsin
Thurner Heat Treating Co., Milwaukee
Wesley Steel Treating Co., Milwaukee

No Argument

"Well, Mr. Maxwell," said Joe to the general manager, "I'm it."

"You're what, Joe?" asked the G.M.

"President of the union," said Joe. "The boys elected me last night. I'm supposed to tell you whenever they've got any demands or grievances."

"Glad to hear they picked you instead of some others out there I know, because you and I can talk sense," said the G.M. "In the first place, I guess we realize that we're both on the same side of the fence."

"How's that?" asked Joe.

"I mean," said the G.M., "that for you fellows in the shop to get yours and for me to get mine, this business must be a success; it must make a profit. As to just how the profits are to be divided we may disagree, but up to that point, there can be no argument. We're all in the same boat."

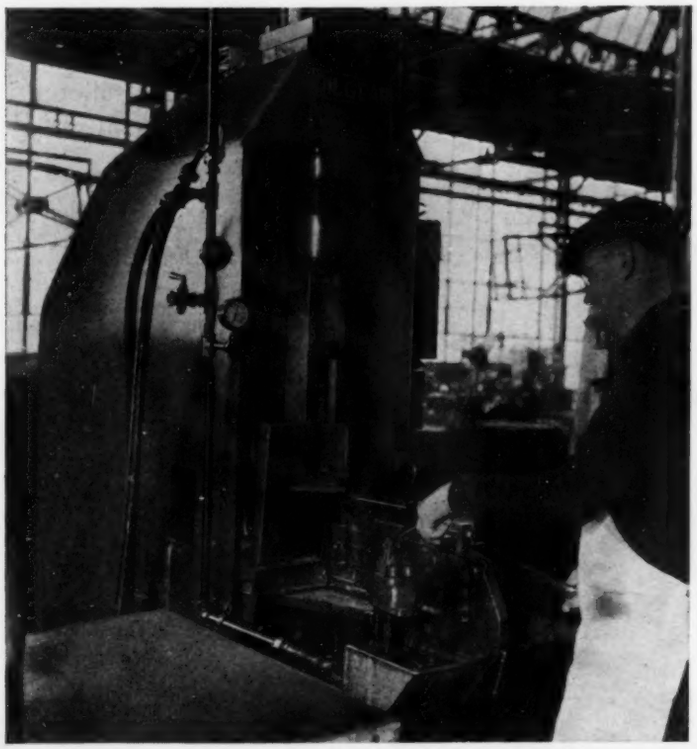
"Sure," said Joe, "my six-year old kid could see that. We've got to make it first before we can split it. There'll be no argument on that."

"But be sure to remember that, Joe. You'll have hot heads out there and worse—some malcontents who will want to block any peace between employees and their management. We'll put in a new line of machines or find a better method of making our product, and some of your boys will be on your neck with a 'grievance.'"

"I get you, Mr. Maxwell, but I don't think any of us wants to block progress."

"A few of you will—but not most of you, intentionally. Don't let the few cloud up the clear thinking of the majority. Just keep in mind what we both agree on now. Improved methods and lowered costs are the life blood of any business. Let's make the profit first and make it big. Then I can fight for my share and you can fight for yours."

"You're right, Mr. Maxwell, and if any of those buzzards throws sand in a bearing you won't have to fire him. I'll be there first."



When Production Executives Think in Terms of Results The Choice is OILGEAR

There is room in American Industry for all grades of equipment. But production men who are affiliated with the *leaders,* think only on one level—quality production demands quality equipment.

Hence it is vital to note that in a great business machine house, a great electrical manufacturer's plant, one of the most widely known consumption goods manufacturers—that in these and *all* other leading plants, Oilgear Broaches, Presses, etc. have the call.

For the logic of cut costs, reduced maintenance, faster operation, bettered production points clearly and unmistakably to the *superior* Oilgear Machine. THE OILGEAR COMPANY, 1301 W. Bruce St., Milwaukee, Wis.

OILGEAR

BROACHING MACHINES AND PRESSES

Papers for Apprentices

GORDON W. RICHARDS

Here's an idea. You know most companies and shops subscribe to a lot of trade publications and periodicals. Usually a slip of paper containing the names of the "big shots," like the general manager, the "super," the departmental heads and the foremen, is attached to the cover. Then these magazines and booklets are passed down the list, each individual scratching his name off the list when he is through with it and passing it on. In one plant, after the last foreman has seen the publication, another slip of paper containing the list of apprentices is pasted on the cover.

Belt Scraping Eliminated

FRED MERISH

Belts in operation frequently develop the bad habit of striking motor mountings and other adjacent parts. Corrective measures are costly. A maintenance man in one factory reports that he has found an inexpensive way to correct this trouble. In most cases, a belt can be adjusted to run properly by inserting blocks under the motor mounting and raising the equipment up from its foundation in order to permit the belt to run without striking adjacent parts.

In another plant, a larger pulley was installed to reduce the speed of the drive and this change caused the belt to scrape the motor mounting. It was estimated that it would cost $200 to cut part of the base away. Inserting blocks under the mounting solved the problem satisfactorily.

TRADE PUBLICATIONS

BALL BEARINGS Booklet No. R-3, published by the New Departure Div., General Motors Corp., Bristol, Conn., comprises the 1939 edition of the organization's ball bearing interchangeability tables.

BONDED METALS The American Nickeloid Co., Peru, Ill., has published a 32-page illustrated catalog describing a line of pre-finished bright and colored metals.

CARBIDE TOOLS Bulletin No. 11, released by Handy & Harman, 82 Fulton St., New York, N. Y., outlines the correct procedure in brazing cemented carbide tool tips to tool holders.

CENTER LAPPING Bulletin No. 10782, now being distributed by the Ex-Cell-O Corp., 1224 Oakman Blvd., Detroit, Mich., includes features of the No. 74 center lapping machine.

CENTRIFUGAL CASTINGS Bulletin No. C-3, offered by the Michigan Steel Casting Co., Detroit, Mich., gives details concerning a line of "Centricast" pipe and tube.

CHUCKS Details concerning a new segmental chuck are included in a leaflet issued by the Cortland Grinding Wheels Corp., Chester, Mass.

CORROSION Bulletin No. 438, offered by the Alox Corp., 70 Pine St., New York, N. Y., contains 42 pages of information concerning an extensive line of anti-corrosives.

DOWEL PINS A chart offered by Danly Machine Specialties, Inc., 2116 S. 52nd Ave., Chicago, Ill., includes recommendations for drilling and reaming holes for precision dowel pins.

HOSE A data book containing information on the selection, care and use of industrial rubber hose has been published by the New York Belting & Packing Co., 1 Market St., Passaic, N. J.

KENNAMETAL Catalog No. 2, announced by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa., discusses the features of Kennametal-tipped tools and blanks for metal-cutting applications. Available to all plant operating and purchasing officials, this 24-page catalog is designed to give full information regarding the application of this metal.

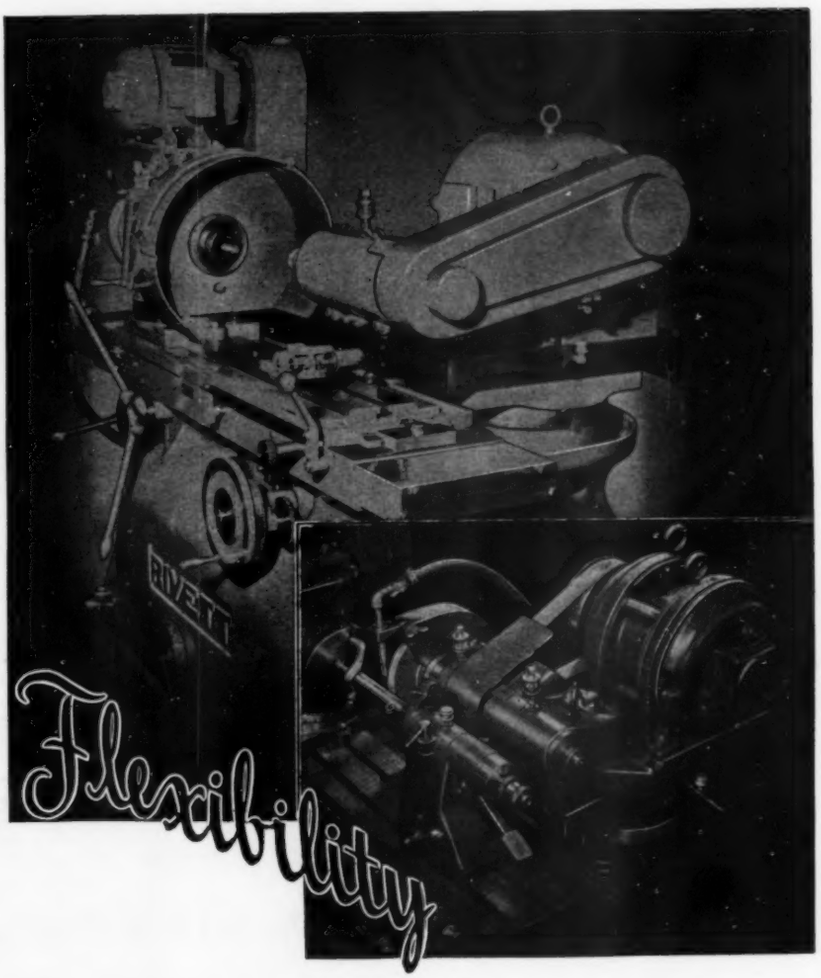
MATERIALS HANDLING Folder No. G5-38, issued by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, illustrates several industrial applications of the Cleveland tramrail overhead materials handling systems.

METAL FASTENINGS A complete line of self-tapping screws for fastening to metal, plastics, wood or masonry, is described in a 68-page illustrated catalog published by the Parker-Kalon Corp., 200 Varick St., New York, N. Y.

METAL HEATERS A folder published by the American Car & Foundry Co., 30 Church St., New York, N. Y., gives specifications regarding the "ACF Berwick" line of electric metal heaters.

METAL HOSE "The Fact Book of Flexible Metal Hose and Tubing," issued by the Flexible Metal Hose & Tubing Institute, 150 Broadway, New York, N. Y., contains 20 pages illustrating the uses of flexible metal hose in many types of industrial applications.

NICKEL ALLOY Revised Bulletin No. T-9 offered by the Development and Research Div., International Nickel Co., 67 Wall St., New York,



No. 112 UNIVERSAL GRINDER

Primarily is for medium and large internal and external tool-room grinding, straight, bevel, two angle or straight and bevel at one setting. Wide range of adjustments makes it effective on a great variety of work while its extreme simplicity of design enables any mechanic to operate it. Complete specifications sent on request.

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

N. Y., gives engineering properties and machining characteristics of "K" Monel.

PERFORATED METAL The Diamond Mfg. Co., Wyoming, Pa., has released a pamphlet showing several designs of perforated sheet metal.

PLASTICS The Plaskon Co., Toledo, Ohio, has published an illustrated booklet, "Molded Color," which discusses some of the more outstanding applications of Plaskon.

PLATING Series A No. 79, of the technical publications of the International Tin Research and Development Council, 149 Broadway, New York, N. Y., discussed the nickel and chromium plating of tin plate.

POWER TOOLS An extensive line of wood-working and metal-working tools is described in a 48-page illustrated catalog, No. G-9, published by the Walker-Turner Co., Plainfield, N. J.

PRESSES A 12-page illustrated catalog published by the V. & O. Press Co., Hudson, N. Y., features a line of high-speed notching presses.

RESISTANCE WELDING A folder released by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes the "Weld-O-Trol" power switch for resistance welders.

RESISTANCE WELDING The General Electric Co., Schenectady, N. Y., describes the "Ignitron" contactor for spot and projection welders in Bulletin No. GEA-3058.

RUST PREVENTION The "Parkerizing" process of rust prevention for iron and steel is discussed in a 24-page illustrated booklet released by the Parker Rust Proof Co., Detroit, Mich.

SAFETY "Safety in Steel," a 20-page illustrated booklet published by the American Iron & Steel Institute, 350 Fifth Ave., New York, N. Y., outlines developments and present practices concerning safety in steel mills.

SEAM WELDING Leaflet No. GEA-3101, issued by the General Electric Co., Schenectady, N. Y., gives data regarding the type CR7503-B20A electronic seam welder control.

SMALL FURNACES A booklet now being distributed by the American Gas Furnace Co., Spring and Lafayette Sts., Elizabeth, N. J., describes a line of small furnaces, appliances and accessories.

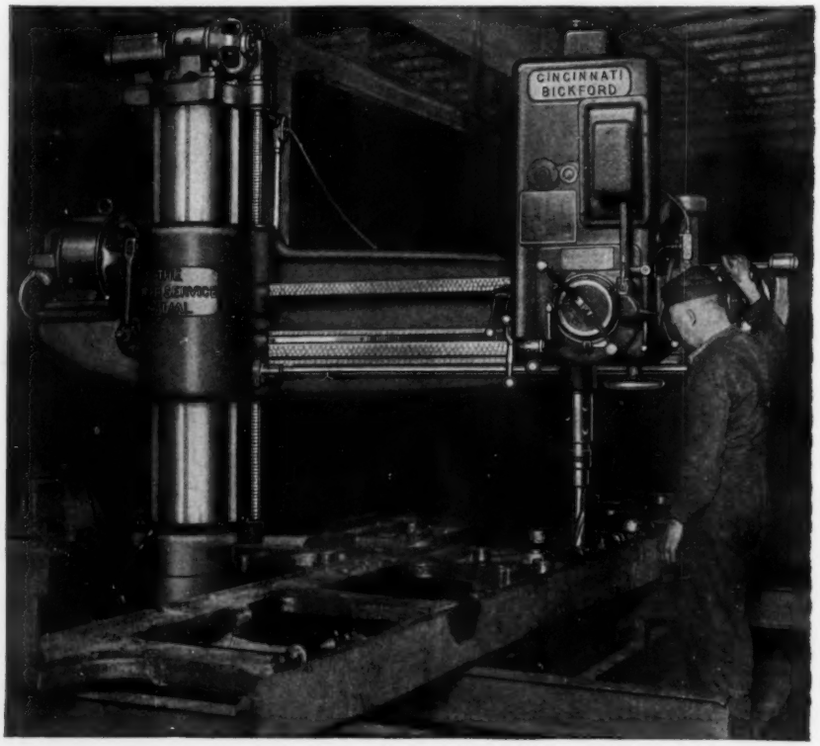
THREAD GRINDING A pamphlet issued by the Detroit Tap & Tool Co., 432 Butler St., Detroit, Mich., discusses current thread grinding practice and applications.

TOOL BITS A folder released by the Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y., gives specifications concerning the "Rex" line of high speed steel tool bits.

TRANSMISSION Details of a new variable speed transmission are given in Leaflet No. 314, now being distributed by Graham Transmissions, Inc., 2711 No. 13th St., Milwaukee, Wis.

TRANSMISSIONS Specifications of several models of the "Vari-Speed Motodrive" for machine tool and other industrial applications are included in an illustrated folder published by the Reeves Pulley Co., Dept. A-128, Columbus, Ind.

TRENDS The Public Affairs Committee, Inc., 8 W. 40th St., New York, N. Y., is distributing a bulletin entitled "Machines and Tomorrow's World," prepared by Dr. William F. Ogburn, professor of sociology, University of Chicago. This pamphlet is a summary of the report on technological trends and national policy made to the National Resources Committee by the Subcommittee on Tech-



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Especially on big work centralized control at the drilling position makes important savings. Controls for all speeds and feeds—electric column clamping—arm clamping and elevation to the arm—power rapid traverse—controls for these and all other operations of the SUPER SERVICE RADIAL DRILLS are always within easy reach from the drilling position. Think what time and energy are wasted when that is not the case! Yet most of the radial drills in use today do not have this money saving feature of 100% centralized control at the head. Do yours?

Write for Bulletin R-24.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

nology, of which Dr. Ogburn was chairman. Price, 10 cents per copy.

TUBE BENDERS Several sizes of hand tube benders are described in a leaflet issued by the Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio.

WELDING APPARATUS The Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y., has published two new catalogs covering the line of "Airco" welding and cutting apparatus and supplies. Catalog No. 22 features hand welding equipment. Catalog No. 21, designed to help the large user of oxy-acetylene equipment, contains descriptions of acetylene generators, industrial gases and oxy-acetylene machines.

WELDING CONTROL "Thyratron" half-cycle welding control equipment is discussed in Folder No. GEA-3045, offered by the General Electric Co., Schenectady, N. Y.

NEW BOOKS

KNOW YOUR STEEL—*By Halfdan Halvorsen. 107 pages, 3¾ x 6½ in., indexed. Flexible, loose-leaf binding. Published by H. M. Halvorsen, P. O. Box 63, Harper Station, Detroit, Mich. Price,* $2.00.

Data regarding the proper heat-treatment of more than 600 of the best known steels are included in this convenient publication. These steels are classified according to type and are listed according to commonly used trade names.

•

BLAST FURNACE PRACTICE.—*By Ralph H. Sweetser, consulting engineer. 356 pages, 6x9 in. Clothboard binding. Indexed and illustrated. Published by the McGraw-Hill Book Company, 330 West 42nd St., New York, N. Y. Price,* $4.00.

Pig iron stands between the mined ore and the iron or steel fabricated to usable form. As an intermediate product, its importance has been underestimated, its metallurgy too little understood. The high degree of technical effort put into steel mill melting and rolling practice could well go back to the blast furnace to improve further the quality of the finished product.

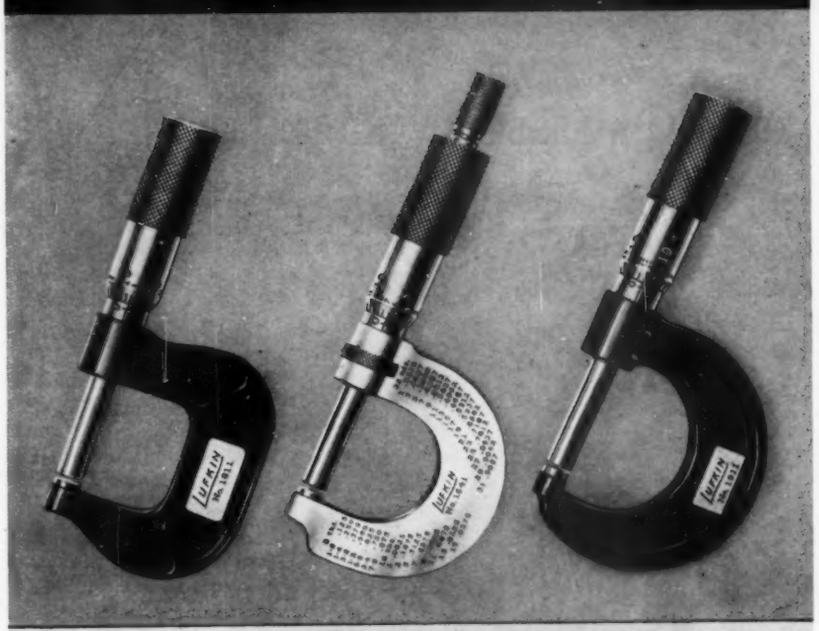
The blast furnace itself has been "on the spot." With talk of "direct metal" methods there were hopes that the pig would be short-circuited and that the thermal losses incident to cooling and remelting might be avoided (though according to the author pig iron may be liquid, too). No doubt his feeling was largely responsible for the fact that no new blast furnaces have been built in the United States for the past ten years.

The author claims that the blast furnace has proved itself as an efficient and economical medium of producing pig iron. He suggests a closer study of the solid, liquid and gaseous products of the modern blast furnace; and he offers in this text a discussion of the factors which will make these products better understood.

METAL COLORING AND FINISHING.—*By Hugo Krause, consulting chemist to the metals finishing industry. Authorized translation from the second revised edition. 222 pages, 6x9 in. Clothboard binding. Indexed. Published by the Chemical Publishing Co., 148 Lafayette St., New York, N. Y. Price,* $5.00.

Chemical, mechanical and electrical methods of metal coloring and finishing are discussed by the author in this volume, translated from the German. In treating the subject, an attempt is made to include both theoretical and practical applications, as well as the

GET LUFKIN FOR ACCURACY



THE BACKBONE OF INDUSTRY

Anyone can well imagine how far industry might have advanced without precision tools with which to produce articles on a large scale to exacting limits of accuracy.

Industry today demands precision more than ever before — and Lufkin Precision Tools meet this demand better than it has ever before been met. They are easier to use, last longer, and give even more dependable results. Mechanics and engineers everywhere use them with complete confidence. Write for Precision Tool Catalog 7.

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TAPES — RULES — PRECISION TOOLS

patent angles. The comprehensive approach attempts to cover all important methods supplied to iron and steel, and the base and noble metals, in their various fabricated or electroplated forms. Many of the so-called secret processes of the electroplating are described in considerable detail.

In this second edition, the author claims to have eliminated a good many of the processes described in the first volume in order to confine his description to the preferred methods of performing certain operations. In order to avoid technical errors, the translators have closely followed the original style which in some instances causes the sentences to be lengthy and involved.

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GRINDING WHEELS AND THEIR USES.—*By Johnson Heywood under the auspices of the Grinding Wheel Manufacturers Association and the Abrasive Grain Association.* 374 *pages,* 6x9 *in. Clothboard binding. Indexed and illustrated. Published by the Penton Publishing Company,* 1213-35 *West* 3*rd St., Cleveland, Ohio. Price,* $3.00.

Metal-working operations today are given such careful study that those who are charged with the responsibility of efficient production require a detailed knowledge of the individual steps used in manufacturing a given product. Specialization is required, not only in considering the methods but in the literature concerning them.

In specializing on grinding operations, Mr. Heywood has attempted, first of all, to furnish a handbook on modern practice. He readily credits the material included in his work to a wide number of sources including engineers on the staffs of grinding wheel and grinding machine manufacturers; methods engineers and designers in shops which perform grinding operations on their products; and foremen and employees of grinding departments.

The result is a comprehensive treatment of the present status of the art of grinding with regard to a particular application to current production problems. Included is a good deal of tabulated material dealing largely with grinding wheel recommendations for specific jobs.

Why

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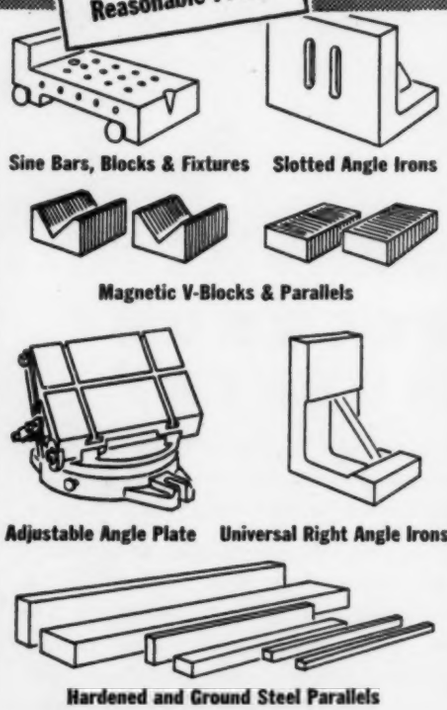

Sine Bars, Blocks & Fixtures
Slotted Angle Irons
Magnetic V-Blocks & Parallels
Adjustable Angle Plate
Universal Right Angle Irons
Hardened and Ground Steel Parallels

Foremen find that these *standardized* specialties save time . . . and widen the range of machine application (a point of prime importance to tool shops and small manufacturers).

Inspectors in precision plants know that these tools are vital safeguards to accuracy. They also know the value of being able to secure such equipment immediately *from stock.*

Shown here are a few of the specialties developed in the T-P plant to solve problems of set-up . . . every item made to Taft-Peirce standards of quality and accuracy. Complete line is described in our Handbook. *Write for a copy.*

The
TAFT-PEIRCE
MANUFACTURING CO.
Woonsocket, R. I.

A COMPLETE LINE OF SMALL TOOLS & GAGES

Young Tom's plan for Independence!

JOHN GODFREY

Young Tom Johnson has some ideas of his own. While he probably inherited some of his notions that are contrary to run-of-mine ideas, from Old Tom, he seems to have left the old man at the post when it comes to handling modern problems. It's probably because they are new problems that Old Tom isn't so sure but that young Tom is going too far.

Anyhow here's the gist of what young Tom told the Chamber of Commerce not long ago when they were discussing the all too present question of unemployment and relief. Old Tom told me about it, with a sort of funny mixture of pride in young Tom's new ideas, and doubt as to his being really sound in his thinking.

"We'd been discussing unemployment relief and cussing, in polite language, of course, the way things were going in Washington. Seems to be a favorite sport among us business men whenever we have to pass a dividend, or don't pay as much as we'd like. Doesn't seem to make much difference who happens to be President, we use him as a whipping boy just the same.

"They'd been talking about the wastes in government; how much better business men could run things in

general—and especially the cost of relief as now administered. Finally Tom got a chance to spout and he sort of jarred a lot of them in several ways.

"Roughly speaking, Godfrey, Tom's theme song was something like this. Sez he:

" 'We've been discussing the cost of relief for the unemployed. We all agree that it costs too much and that it is a handicap to business. Many of us feel that money is wasted even when honestly administered. Why don't we do something about it?

" 'Most of us agree that all wealth comes from industry. Whether it's our own shops and factories, the mines or the farms, industry pays all the cost of government in the form of taxes. We pay more and more taxes as the years go by. It costs money to collect these taxes. It costs more money to distribute the millions that are being paid to those on relief.

" 'Let's do something about it!

" 'If, as we claim, all money comes out of industry why not handle the matter direct? Why not have the business men in every community take over the handling of relief? Instead of having the government spend money to collect taxes and distribute them in our town, let's tax ourselves, look after our own poor, and save money that now goes into overhead of tax collection. We might incidentally keep some of it out of the hands of bosses who now use it to build up their own political machines.

" 'It's dollars to doughnuts that most of us would find ways of using a few more men if we felt that we had to pay them anyhow, in direct taxes. There's no use kidding ourselves that some one else pays their relief checks. We do it indirectly, as industry pays all the bills in the long run. Perhaps this town can't do it alone. But we can make a start toward getting back the independence we like to shout about.

" 'We have to pay the bill anyhow. Why not control the money here at home? Why not save what we feel sure is now wasted? Instead of just bellyaching about centralization of power in Washington, why not do something about getting, or keeping, control in our own hands?' "

Wasted Man-Power

Dear Boss:

Lately you have stressed the point that there seems to be too much work scrapped, metal going to waste, throughout the shop. You have asked that we be a little more careful.

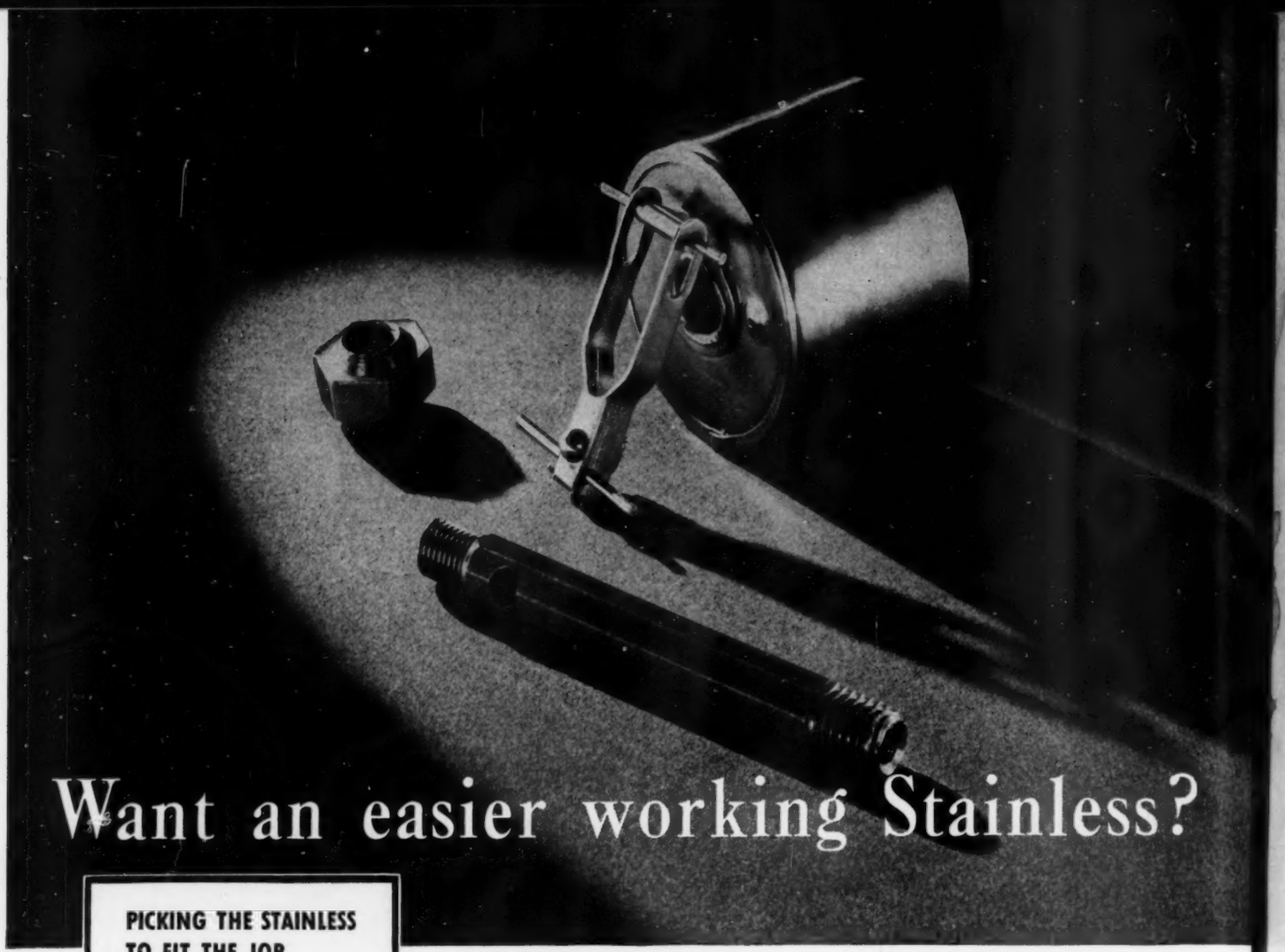
Of course, you're right. There has been too much waste. But at the time I just happened to think perhaps there's a greater, though much different type of waste going on, a more important type really. I refer to the waste of "man-power."

Yes, men can be "wasted" too—not only in this particular shop, but everywhere! Men doing jobs too small, too easy for them, men capable of much better things. And the very fact that a man *can* do better work and is unwittingly held back, means a "wasted" ability.

With skilled workers at such a premium, it seems strange that managements fail to uncover these "hidden" possibilities within their own ranks. Certainly it would be worth the effort—nothing can be lost and perhaps a world of wealth gained. Just gradually advance each employee to a little better grade of work. Give him a little additional responsibility. Don't worry, if you show him you're interested, he'll reflect that interest twenty-fold. Why, so refreshed, he may even find for you better ways of doing things!

Sincerely,
Clock No. 2506

Local engineering service and warehouse stocks at principal industrial centers



Want an easier working Stainless?

PICKING THE STAINLESS TO FIT THE JOB

On these steam trap parts, stainless was used to resist the erosive and corrosive action of high pressure and temperature steam. Hexagonal bolt and nut and 2 small pins are of Carpenter Stainless No. 5 for free-machining. Bucket, clevis, and bracket lever were formed without trouble from Carpenter Stainless Strip No. 4.

HERE'S A SUGGESTION. Try Free-Machining Stainless. You can give your product all the advantages of stainless and still keep costs within reason.

Ten years' experience with this alloy since its announcement by Carpenter in 1928 has shown that Free-Machining Stainless . . .

- *Can be machined with standard shop tools at speeds 50% to 100% faster than ordinary stainless steels.*
- *Can be ground at approximately half the cost.*
- *Has corrosion and heat resistance characteristics comparable to any other 18-8 or 14% chromium steels.*

THE CARPENTER STEEL COMPANY

Carpenter FREE MACHINING